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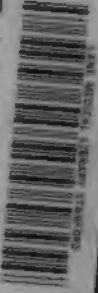
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A TEXT-BOOK
OF
MATERIA MEDICA
PHARMACOLOGY AND THERAPEUTICS

BY
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Sixth Edition, Thoroughly Revised and Enlarged
And Adapted to the Eighth Revision (1905) of the U. S. Pharmacopœia

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TO

THE MEDICAL STUDENTS OF THE UNITED STATES,

**IN THE HOPE THAT IT MAY AID THEM IN ATTAINING A CORRECT
KNOWLEDGE OF THE NATURE AND ACTION OF DRUGS
AND THE RATIONAL TREATMENT OF DISEASE,**

THIS WORK IS CORDIALLY INSCRIBED BY

THE AUTHOR.

89622



PREFACE TO SIXTH EDITION.

I WOULD be unappreciative if I failed to take this opportunity to express my gratification at the continued popularity of this Text-book, as shown by the necessity for the publication of another edition. Therefore, I desire to thank the medical profession, and especially the teachers of materia medica and therapeutics in the many colleges in which the book has been used, for the hearty reception which heretofore has been accorded it.

The book is the fruit of some twenty years' experience in teaching therapeutics and clinical medicine, and many years of private and institutional practice. It has been my effort to embody as much as possible of this experience in a condensed, carefully classified, and usable form. Above everything else, I desire this book to be practical rather than theoretical. It is important not only that the student should acquire the largest amount possible of knowledge of the remedies which he expects to use in the practice of medicine, but also that this knowledge should be systematically and logically arranged, so that it may become immediately available. I believe that the classification which I have adopted particularly lends itself to that end, and that it will greatly facilitate the study of this important branch of medicine.

While the needs of the student have been kept in the foreground, I have not forgotten the demands which are made upon it by the practising physician. I have, therefore, endeavored to make the subject-matter as complete and as detailed as the size of such a work will permit, and to give special prominence to the therapeutic sections. In this field I have drawn largely upon my own experience, not forgetting the larger mine of current medical literature.

PREFACE TO SIXTH EDITION.

of the official remedies in this edition has been accord with the Eighth Decennial Revision of the *opœia*. All the official remedies are mentioned. These, a few non-official remedies that have been to be of sufficient importance, as shown by their widespread employment, have been accorded a place. I believe that the unfortunate agnostic tendency toward therapeutics, and the prevalence of nostrum prescribing in the profession, are the natural and inevitable results of the therapeutics in our medical schools. Every effort has been made to intensify the students' interest in this branch of their knowledge not only more complete, but of a more readily put into practical application. If this book has attained that end, I shall feel that it has accomplished its purpose.

I acknowledge the unfailing courtesy and patience of my friends, and cordially to thank Dr. John C. Hollister, of New York, for his valuable contribution on the Opsonic Index.

G. F. B.

PREFACE.

THE present work has been undertaken with the immediate object of supplying the student of medicine with a clear, concise, and practical text-book, adapted for permanent reference no less than for the requirements of the class-room.

The arrangement—embodying the synthetic classification of drugs based upon therapeutic affinities—the author believes to be at once the most philosophical and rational, as well as that best calculated to engage the interest of those to whom the academic study of the subject is wont to offer no little perplexity.

Should an intelligent and comprehensive understanding of *Materia Medica* and *Therapeutics* be facilitated by the author's treatment of the theme, the deductions derived from his experience as a practitioner and instructor will not have been committed to print in vain.

Special attention has been given to the *Pharmaceutical* section, which there is reason to hope will be found exceptionally lucid and complete. It has been deemed advisable, however, in the general work to include in the descriptive enumeration only such drugs as experience has proved to be of unquestionable value and are of standard and authoritative acceptance in general practice. In accordance with this plan, many new and comparatively untried remedies have been omitted, since, while of established efficacy in certain conditions, they are as yet too imperfectly known to warrant association with remedial agents bearing the sanction of exhaustive scrutiny. So, too, a few official drugs have been excluded because they are practically never used or are employed only in isolated instances.

It will be observed that "*Untoward Action*" and "*Poisoning*"

are treated under separate heads. By the former it is intended to record the effects of *medicinal doses* in developing certain symptoms dependent more or less upon individual susceptibility, not necessarily assuming the aggravated form incident to toxic doses, which exert a definite influence regardless of idiosyncrasy.

In giving the careful Latin accent and quantity of medicinal nomenclature (Foster), so far as practicable with the prosodial signs employed, the design has been to correct a prevalent disregard of proper pronunciation reflecting little credit upon those to whom a knowledge of the subject should be as exact as it is familiar. To the prescription-writer the appropriate Latin genitive, and in a few cases the accusative, will doubtless afford valuable assistance.

During the preparation of the work many important text-books, periodicals, etc. have been freely consulted, and from the U. S. Pharmacopœia chiefly, and from the National Dispensatory, have been adopted almost *verbatim* the "*Origin*" and "*Description and Properties*" of the various drugs under consideration.

In reviewing the progress of the present volume the author desires to express his cordial acknowledgments to Prof. Carl S. N. Hallberg, Ph. G., whose exhaustive contribution of "*WEIGHTS AND MEASURES*" and "*PHARMACEUTICAL PREPARATIONS*" cannot fail to lend permanent interest to the work; to Dr. Alfred C. Cotton, Dr. Wm. E. Quine, and Dr. James B. Herrick, for friendly suggestions; to Dr. D. Lee Shaw, Dr. Fred C. Zapffe, and Dr. Thomas J. Jackson, for assistance in compilation. To Mr. Storrow Higginson the author's personal thanks are due for his scholarly assistance in the revision of the text.

G. F. B.

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A TEXT-BOOK



MATERIA MEDICA, PHARMACOLOGY, AND THERAPEUTICS.

INTRODUCTION.

THE history of medicine since the earliest times is the record of a more or less continuous series of experimental researches, having for their paramount object a precise and comprehensive knowledge of the nature of disease and the practical application of remedial agents. The various "schools" which have arisen from time to time are philosophically co-ordinate, their fundamental principles being referable to one dominating thought—the art of healing.

It is scarcely practicable here, even were it necessary, to review in detail the separate doctrines which have obtained during the evolution of sectarian therapy. From the earliest ideas promulgated by the ancient priests of Æsculapius, through the subsequent era of Hippocrates, Theophrastus, and the Alexandrian school, influenced by the crude, misguided notions prevailing ere science emerged from its infancy; discernible in the Galenic and other tentative yet memorable systems, in the epoch of Paracelsus and the Monastic Medicine of the Mediæval period, and in the radical theories of Rasori and Roeschlaub which attended the development of the eighteenth and have left a passing impress upon the nineteenth century,—through all, the gradual acceptance of empiricism as a legitimate guide to therapeutic truth is manifest. Yet viewed with reference to their underlying animus, these varied expressions of scientific endeavor distinguishing the part are perceptibly linked with the ampler system which has emanated from the more rational methods of modern research.

The light of inductive reasoning and the marvellous progress in scientific knowledge which characterize the nineteenth century are a living appeal from the idealism of a less enlightened age. The release from tradition—anticipated in the labors of Bichat and others—to which later investigation owes so many signal triumphs has doubtless been profoundly affected by the realistic tendency of modern thought. It is to the startling advancement attained in the natural sciences, however, resulting in a chemical skill and in mechanical appliances of incomparable value, that we must look for the originating impulse which has inspired the therapeutic knowledge of the present day. It needs but little reflection to perceive the immeasurable superiority of actual acquirements over the vague, hesitating—though ardent and laborious—methods to which the theory and practice of medicine were so long subservient.

We have said that, considered in the larger sense, the history of medicine has been a harmonious rather than an intermittent development. It is not to be supposed that, in the evolution of so momentous a scheme as the formulation of a remedial system applicable to the extensive catalogue of human ailments, there should not have occurred spasmodic and ill-adjusted theories, crystallizing in many a strange *cultus*, which, if ineffectual in retarding the onward sweep of rational progress, has, it may be safely averred, worked incalculable injury to the cause of medical truth. Mesmerism, astrology, spiritualism, even theosophy, however incongruously conjoined, and similar vagaries have not failed to enlist among their votaries many enraptured, even noted, believers; nor is the mental strabismus with which they are afflicted amenable to any resource of rational treatment. We need, moreover, but contemplate the pitiable hallucinations which urge the pious pilgrimages to Marpingen, Lourdes, and Trèves, and the criminal negligence and incredible offence to reason which stultify the so-called "Christian Scientists" (as ironical a misnomer as language permits), to realize that miraculous cures still hold blighting yet potent sway over the minds of the ignorant and credulous. May not even the assumption of thaumaturgical powers be one day possible with those who arrogate to themselves a knowledge little short of omniscience, and to whose rudimentary intelligence the laws of nature convey no perceptible lesson? As from the sublime to the ridiculous, so from faith to fanaticism, it is but a step, after all.

It is appropriate here to emphasize the unfailing—nay, ever-

increasing—importance of therapeutics in its relation to the welfare of mankind. Especially imperative is this obligation in an epoch of unprecedented achievement in every department of science which contributes to the perfection of the healing art, in which general advancement medicine has borne no inconspicuous rôle.

The rapid advance of experimental science, however, applied to medical treatment, culminating in bacteriological discoveries of signal value to mankind, and the remarkable triumphs attending the development of operative surgery, have inevitably tended to disparage the equally noble and far more widely cultivated field of therapeutic science. This result is the more deplorable since it creates in the minds of the young and inexperienced an impression of contrast and divergence in departments of study naturally and indissolubly correlated. It is scarcely surprising that the marvels of the laboratory and the splendid achievements of the arena should possess for the tyro an entrancing interest. Yet it is to be borne in mind that the most brilliant triumphs of diagnostic and surgical skill might prove futile as the means of arresting disease were they not supplemented by the *course of treatment* which constitutes *therapy*.

It must be confessed that medical art has too often been discredited by professional incompetence, and consequent failure to effect the *cure* which with the laity is wont to form, however ignorantly, the only criterion of ability. In America especially—where from defective laws the widest latitude is given to incapacity and imposture—the lack of proper academical training is frequently the cause of serious consequences in practice, little calculated to enhance the popular confidence and esteem. It therefore behooves the student of medicine to master thoroughly the details of the remedial art, become practically conversant with physiological conditions and the manifold phenomena of morbid anatomy, and so familiarize himself with the varying indications of disease that in the presence of whatever malady, his diagnosis and treatment may command respect—not only from the laity, but, what is of far more consequence to him, from the profession.

It is almost superfluous to lay stress upon pharmaceutical knowledge as a powerful weapon in the armament of the medical practitioner. Yet no branch of therapeutic science has, perhaps, been more neglected than a practical acquaintance with the nature and uses of *Materia Medica*, their origin, potency, and characteristic value, as well as their physiological action, and the incompatible

and synergistic agents upon which their efficacy often largely depends.

Thanks to careful and competent training among pharmacists, the skilful preparation and dispensing of drugs relieve the physician of much responsibility; yet he should be keenly sensible of the fact that the larger share of public confidence is reposed in him, and by diligent study of the subject endeavor to command the minutiae of pharmacology, holding himself morally accountable for errors quite possible in the druggist's dispensary. It may not be irrelevant to add that in all medical procedure a sympathetic yet perfectly controlled nature, ready tact, and sterling common sense are cardinal requisites to professional triumph, it being generally true, as was long since observed by Hufeland, that "successful treatment requires only one-third science and two-thirds *savoir faire*."

Finally, the author would counsel the utmost seriousness in the pursuit of a calling which might aptly be termed "Christian Science"—the power to alleviate human suffering by means of curative agents with which the laboratory of nature has been mercifully stored. There can be no loftier, more practical manifestation of love to men than is exemplified in the benignant effort to assuage the ills to which mortality is heir; nor can any devotion be more privileged and inspiring than that which softens the shock of disease, illumines the darkness of mental and physical distress, and from the debris of misfortune, vice, and heredity creates anew the image of divine perfection. It is this uplifting, consecrated zeal, akin to veneration for medical science, which has endeared to the world the masters of the profession—of which the same wise Hufeland said: "To him who fails to make a religion of the healing art it is the most cheerless, wearisome, and thankless labor upon earth; indeed, in him it must become the greatest frivolity and a sin." And for those—and they are many—to whom the material, possibly mercenary, aspect of their task appeals unduly it is enough to cite in rebuke the elevated maxim of Stigelius:

Non omnia quae suscipimus lucrum spectant.

[*Thunbergii Dissertationes.*]

PHARMACOLOGY AND GENERAL THERAPEUTICS.

Nature heals, physicians treat—is a truth of old that is constantly forgotten: always by the patient, who expects the patent medicine or the family doctor to *cure* her; frequently by the physician, who is often persuaded, against his better judgment, to believe in the supernatural when the mysteries of drug action are involved. A few propositions concerning the general action of the human body in its endeavor to heal itself may not be out of place in an introduction to a work on the practice and art of aiding nature's forces in the treatment of abnormal conditions.

It is a difficult task to express, in a few phrases, the general causes of disease, but the following general agencies may be considered:

1. *Trauma*, whether the result purely of accident, or brought about in the general struggle for existence.
2. *Parasites*, both microscopical and macroscopical, acting within and without the body.
3. *Poisoning* from plants and animals, broken down and decomposed food-stuffs, and poisonous gases taken into the respiratory tract.
4. *Bad hygiene*, unwise modes of living, including faulty nutrition, faulty modes of dress, eating, and housing, use or abuse of certain organs or their lack of use.
5. *Heredity*.—Here would be classified not only the directly transmissible diseases, as syphilis, but also those constitutional dyscrasias that conduce to premature break-down of some part of the human body.

In order to combat these various agencies the individual organs have developed a system of natural cure methods ("natural therapeutics") that are of interest. These may be summarized briefly, following Kobert, in part, as:

1. *Healing by regeneration*. Among the lower animals the regeneration of a lost member is not infrequent, but in man it is unusual. In a sense, however, the healing of wounds as a part of

the inflammatory reaction is analogous to this process in the lower animals. The hypertrophy of one kidney, compensating for the loss of the other, and the establishment of a collateral circulation are illustrations of what Bachmann, in 1894, pointed out as the law of equivalent compensations.

2. Healing may be brought about by the exercise of an organ. Thus, the old-fashioned system of exposure to wet and weather develops, by exercise of the skin, an increased resistance to agencies that otherwise might react harmfully on the organism.

3. In the struggle against parasites it would appear that the body had developed an extensive array of protective agencies. Thus, antiseptic substances in the saliva, gastric juice, and bile are simple instances of this protective power against parasites from the outside. The doctrine of phagocytosis embodies the principle of the action of the white blood-cell in its office as a protective agent. In the body-fluids are found *alexins*, *antitoxins*, immunizing proteids that protect from the actions of poisons which may develop as a result of the life activities of these parasites should they obtain a foot-hold within the body—or even protect from poisons developed in the course of disturbed metabolism. Fever, so frequently regarded as an adverse sign in disease, undoubtedly serves in large part as a means of protection of the body—by killing the agents that have induced the rise in temperature.

4. Healing from certain poisons is brought about by vomiting and diarrhea, by rapid elimination through diuresis, or by excessive perspiration. Within the body a most interesting series of changes often takes place—thus, splitting up of poisons, their oxidation or conversion, or even fixation, into non-toxic products is a constant phenomenon. Thus even so powerful an alkaloid as morphine is said by Faust to be in part oxidized and perhaps used as a food-stuff. The chemical changes that take place in the liver have here their most potent activities, and the pathological chemistry of the twentieth century promises to throw much light on these complicated problems. Poisons also are compensated for by the process of adaptation (habituation), and are frequently rendered inert by the development of specific antitoxic substances. Thus specific anti-morphine bodies have been developed in the blood of some of the lower animals.

5. The physiological process of *rest* is an expression of nature healing. Loss of appetite is the indication not to eat. Pain calls for rest.

6. Healing by the casting off of a portion of the organism is a process of nature healing widely made use of in diseases among plants and the lower animals. Abscess formation, the limiting, by fibrinous exudates, of intraperitoneal irritants, and spontaneous gangrene of the extremities are well-recognized examples of such a type of nature's healing.

Treatment is something apart from healing, and in its broad sense comprises all those means, psychical or physical, which the practiser of the healing art has at his command by which he can hope to alter an abnormal condition in the individual he is called on to treat. Thus, nature calls into play the highest of her gifts, intelligence, to aid her in the work of self-preservation, and it is the function of the text-book to aid, in so far as it is able, to train that intelligence in the facts that experience has proved of value—in the present instance, in the fields of *materia medica*, pharmacodynamics, and therapeutics.

Pharmacology, from the broad point of view, is the science of drugs, and includes the various fields of medical botany, medical zoology, pharmacognosy, pharmacodynamics, and pharmacy. Within recent years, however, following the German school, its meaning has been restricted and made equivalent to **pharmacodynamics**, or the study of the effects of physical or chemical agencies on living organisms. It is in this sense that it is used in this work.

Materia Medica is the study of the source, constituents, chemical and physical characters of the organic and inorganic materials used for drugs in the practice of medicine.

Pharmacognosy is a division of *materia medica*, and includes the technical study of the crude materials from which drugs are derived. Its deliberation is limited to the animal and the vegetable kingdoms, but it is not a science with sharply defined boundaries, as it encroaches on so many avenues of knowledge—systematic botany, zoology, gross and minute anatomy, chemistry, and pharmacy.

Pharmacy is largely a chemical study. It deals with those manipulations by which the potent principles of drugs are rendered available for therapeutic purposes.

Therapeutics is the art and practice of treating abnormal bodily states; it is the application of the sciences of physiology, pathology, and nosology, and is the concern of the physician. A physician is an engineer who cannot construct but is skilled in conservation and repair. Therapeutics, then, has for its object the restit-

tion to the normal, or, if such is impossible, the giving of comparative comfort to the invalid. Its range of activity, therefore, is extremely wide, and a combination of methods is necessary to the resourceful physician. The following general modes of treatment should be considered:

Suggestion Therapy.—There is little question that the oldest systematic form of therapeutics was a type of suggestion therapy. In the old type of "Temple Sleep" we find the earliest use of this form of therapy. Magnus¹ has shown that the earliest relations of religion and medicine were to be found in the "Temple Sleep" procedure. To the earliest Egyptians priest and physician were one. There were priests not physicians it is true, but no physicians who had not priestly functions. Throughout the entire Egyptian civilization this double function flourished and even passed on into the Grecian system, where it persisted for centuries. We all know that certain organs of the body were under the care of certain gods or goddesses—some singly, some having charge of many organs if not the whole body. The early Egyptian god, Thoth, had the digestion under his particular care, and it is said that this mythical personage invented the clyster pipe. Thus the modern formula, "Fear God and keep the bowels open," is apparently of prehistoric Egyptian origin. The rationale of much of this priest therapy was to sleep in the temple of the god overnight. There in the quiet and repose of the holy place, providing it were not too popular, the god would appear to the sick one in the form of a dream, and would designate the remedy needed. Modern clairvoyant quacks pursue the same method. No. 59 for colds, so extensively advertised, is said to have been devised in a similar manner.

This method of treatment, it is known, was not uncommon even as late as the time of the Roman emperors.² In the Greek temples all were allowed save those so hopelessly ill that it seemed foolish. The procedure for those patients admitted to the temple was for the priests to narrate the wonderful results to be obtained by the step which was to be taken; thus was desirable confidence imparted. Then various prayers and ceremonies were gone through with and certain sacrifices made; the sacrifice being the ancient analogue of the "fee." After the "preliminary" conditions had been complied with, the ancient priest, it may be observed, obtained his retaining fee in advance, those patients who were more

¹ "Relation of Medicine and Religion," *Culturgeschichtliche Bilder aus der Entwicklung des ärztlichen Standes*, 1890.

² Vide Suetonius and Vespanian—Vespasianus, 7, No. 20.

well-to-do were placed in front of the statue of the god on the skin of the sacrificed ram, while the poor were permitted to lie down on a bundle of rags in one corner of the temple. Great stress was then laid on the character of the dreams the patient would have as he slept, for the advice of the god would come in the dream. History has recorded some fearful and wonderful dreams. *Æsculapius* is said to have demanded 120 ounces of blood for one venesection. *Anstides* was put by the gods on a diet of raisins to cure what appeared to be neurasthenia from too much exhorting. It is significant that the ancient gods commanded their patients to go fishing, to go hunting and swimming, and frequent attendance of theatres was an urgent remedy. It was highly essential, in fact obligatory, that the priests should interpret the dreams.

The treatment of temple sleep was the result of a profound religious feeling, and it was carried out with great decorum and seriousness. Implicit and devout confidence in the gods was a *sine qua non*. Thus the temple sleep, separated from its religious accessories, is the prototype of the systematic treatment by suggestion, and this suggestion therapy strutting about in the garb of religion has remained an inseparable companion of the human race from the most remote times of Egyptian civilization up to the present day. With all peoples and at all times, even during our modern century, suggestion has been active in the garb of religion; only that this religious garb has frequently changed according to altered religious and cultural ideas. Faith is one of the oldest therapeutic agencies of which anything is known. As Dr. Osler¹ has so well said, "Faith in the Gods or in the Saints cures one, faith in little pills another, hypnotic suggestion a third, faith in a plain common doctor a fourth. In all ages the prayer of faith has healed the sick, and the mental attitude of the suppliant seems to be of more consequence than the powers to which the prayer is addressed. The cures in the temples of *Æsculapius*, the miracles of the Saints, the remarkable cures of those noble men, the Jesuit missionaries, in this country, the modern miracles of Lourdes, and the wonder-workings of the so-called Christian Scientists are often genuine and must be considered in discussing the foundations of therapeutics." "Physicians use the same power every day. If a poor lass, paralyzed, apparently helpless, bed-ridden for years, comes to me, having worn out in mind, body, and estate a devoted family, and she in a few weeks or less by faith in me, and faith alone, takes up

¹ *Medicine of the Nineteenth Century*, 1901

her bed and walks, the saints of old could not have done more." "The faith with which we work, the faith, indeed, which is available to-day in every-day life, has its limitations: it will not raise the dead: it will not put in a new eye in place of a bad one, nor will it cure cancer or pneumonia or knit a bone; but in spite of the nineteenth century restrictions, such as we find it, faith is a most precious commodity without which we should be very badly off."

Of the various forms of suggestive treatment it is not necessary here to treat. One form, treatment by hypnosis, is worthy of careful study, but its details are out of place here.

Heliotherapy, exposure to the rays of the sun, or, in Finsen's latest developments, to the activities of the x-rays; **aerotherapy**, or exposure to the open air, moist air, dry air, superheated air, etc.—both constitute modes of treating some forms of disease. Much might be said of **Climatotherapy**, the principles of which are not well understood. **Dietetic Therapy**.—This is also a method of antiquity. **Diet**—milk cures, vegetarian diet, meat diets, diets for obesity, for diabetes, etc.—has extreme practical importance, and its principles should be thoroughly mastered by the student.

Physicomechanical Therapy.—This includes a large number of useful procedures—**Kinesotherapy**, or massage and Swedish movements, from which the fantastical osteopathy has developed, is one of the most important. The Chinese and Japanese have used massage for a thousand years, and it constitutes one of their most important therapeutic procedures. Tissot, in 1780, brought the methods in use once more in Europe; Schebe, of Germany, in 1847, and Zander, of Stockholm, in 1865, brought the modern gymnastic procedures to a state of perfection.

Hydrotherapy, involving the use of heat and cold, with modified massage, has justly become a most important therapeutic procedure. E. F. C. Oertel, of Bayreuth, in 1765, and Preissnitz, in 1790, may be regarded as the founders of modern hydrotherapy. Its most useful applications are to be found in reducing temperature, in promoting sleep, and in neurasthenic and weakened nervous states, although its applications in one form or another are numerous. Tonsillitis, pharyngitis, conjunctivitis, abdominal pain, ovarian neuralgias, etc., are all benefited by hot applications.

Hypodermoclysis and **enteroclysis** are special forms of hydrotherapy which are of great value.

Electrotherapy.—Electricity is a potent agent in the treatment

of certain forms of disease. Within recent years more definite ideas have been gained regarding the mode of its action. Space does not permit of more than an indication of the merest outlines in this place, the student being referred to text-books on the subject (Jacoby, "Electrotherapeutics").

In general, two types of current, galvanic and faradic, are employed both for diagnostic and for therapeutic purposes. The galvanic current is of constant flow, low intensity, and small in quantity. It has little influence in causing muscular contractions, but has marked chemical and thermal properties and promotes metabolism. The faradic current consists of alternating to-and-fro currents, is usually of high intensity, and has marked power to promote muscle contractility. The knowledge of the different modes of application should be gained from a good text-book.

In using electricity for diagnostic purposes it is advisable to use the minimum amount of current to produce a desired effect. The two sides of the body should be carefully compared, and the patient should be at rest. It is advisable to have similar electrodes, and they should be applied to corresponding areas on the well side and the supposedly diseased side.

The condition of muscular contractility is investigated in using the galvanic current by making and breaking the current. Under the influence of small to medium currents the normal reaction of a muscle should be that the *anodal closure contraction* is less than the *cathodal closure contraction*, thus, $A.C.C. < C.C.C.$ In a muscle that is just beginning to show signs of a loss of muscular contractility the $A.C.C. = C.C.C.$, whereas if the *anodal closure contraction* is greater than the *cathodal closure contraction* the reaction is known as the *reaction of degeneration*, and is an evidence of disease. Reaction of degeneration must result from almost any extensive lesion of the peripheral motor neuron. It is found in extensive neuritis from toxic causes, alcohol, lead, zinc, carbon disulphide, mercury, malarial poisoning, etc., in acute anterior poliomyelitis or other disease involving the cells in the anterior horns of the cord; it may also occur with extensive muscle disease.

From a therapeutic point of view electricity is having a constantly widening application. The use of the x-rays in lupus and in flat epitheliomata is as certain as it is marvellous, and the application of the Finsen phototherapy is but in its infancy. Electricity is widely employed as an irritant, caustic, and escharotic. In

paralyses of spinal and neuritic origin its properties of stimulating metabolism make it a highly desirable therapeutic measure. When combined with massage and infinite pains and tact, continued for long periods of time, seemingly hopeless paralyses may be very markedly relieved. Eternal persistency is sometimes the price of recovery. In sensory affections the static current often is of service. Mental suggestibility is here an important item, and the static machine lends itself very readily to much quackery. Galvanism is often very useful in relieving the deep-seated pains of sciatica and lumbago. By many, electricity is deemed of no value, and by others as a panacea for all ills. The truth lies in the means. In proper hands it is an exceedingly useful agent, but it has fallen very much in the estimation of the profession because of the great use made of electricity by the charlatan and professional parasites on that portion of society that so delights in being humbugged.

Toxicology.—Pharmacology and toxicology are in a sense the same. They represent quantitative variation only. All pharmacological action represents some variation from normal standards. When such variations reach a point where the disturbance of function threatens to be or is fraught with danger to the well-being or life of the organism, then the subject is suffering from the toxic action of such an agent.

Pharmacotherapy.—This includes the study of remedial agents proper or the use of drug substances. It considers the applications of the teachings of pharmacology to the treatment of abnormal body states. It naturally constitutes the most important branch of therapeutics.

It is not to be supposed that our present elaborate systems of pharmacotherapy have come into existence as they now are found. They have had a natural development, and the various methods have merged, the one into another. Certain arbitrary methods have received special names, such as Empirical, Specific, Statistical, Physiological, Rational Therapeutics, etc.

Empirical Therapeutics implies the application of remedies to which experience has ascribed certain specific properties irrespective of systematic value. It is not based upon experimental research, but rather upon formulæ established by the accumulation of isolated facts—*empiricism*—and practical observation, apart from theoretical reasoning and the relations of physiological phenomena as revealed by modern methods of investigation. Were

it possible to extend indefinitely the list of remedial agents so as to embrace the entire field of therapeutic knowledge, the empirical method might attain the dignity of an exact science. Such, however, is the complexity arising from the manifold, often contradictory, impressions drawn from human experience that for the evolution of a systematic scheme of therapeutics the empirical system must of necessity prove inadequate.

By *Specific Therapeutics* is meant a system of treatment that implies that certain diseases have certain definite antidotes. Thus, mercury and the iodides are specifics for syphilis, antitoxin for diphtheria, antivenin for snake-bite, etc.

Statistical Therapeutics implies a method of treatment that is the outcome of the experience of the results observed in a large number of cases under certain restricted lines of treatment. This method arrives at excellent results if sufficient numbers of cases of the same type can be observed, but disease processes vary so widely in different individuals that the statistical method alone is not unlikely to lead to error.

Physiological Therapeutics consists in the application of the strict interpretations of the pharmacodynamic action of drugs to diseased conditions. With increasing knowledge its principles will prove more and more applicable, but the inherent difficulties of interpretation of all biological phenomena will always make this method unsatisfying.

Rational Therapeutics is a term much in use, but it means simply an application of the various criteria, empirical, statistical, experimental, etc., in the treatment of diseased processes. The rationalist cares less for the name of the disease and more for the disturbance of general organic functions, not isolated symptoms, but group symptoms, which indicate some large functional disturbance.

On the General Action of Drugs.—Broadly speaking, the action of drugs is exerted either locally or systemically, whereas the effects which are known as *reflex action* occupy a middle ground between the two. Many drugs have only a limited action at the point of application, while others possess not only a local, but a **systemic, action as well.**

The action of drugs is fundamentally a question of protoplasm chemistry, but the investigations of the biologist have not yet reduced the interpretations of nature to a question of molecular physics; until they do, pharmacology will retain the words *irritation, stimulation, depression, paralysis, and death* of protoplasm.

Hueppe, in 1891, enunciated the doctrine that all remedies first, in small doses, produced an irritant and stimulating action in protoplasm, to be followed, when used in larger doses, by a depressing or paralyzing action, which might go on to death of the protoplasm acted on. Thus the effects of small and large doses were contrasted; the foundations of the homeopathic idea are closely related to this interesting phenomenon. It is not a universal phenomenon, however, and cannot be designated as a law, as Hueppe claimed. There are a large number of substances that in small and large doses have antagonistic effects, but the antagonism is by no means an equal one. Thus is it a familiar illustration that small doses of morphine increase mental activity by slight stimulation, whereas large doses depress and paralyze and bring about unconsciousness. The grade of excitement cannot at all be made commensurate with the grade of depression by making the doses smaller and smaller. Chloral acts as an irritant to the peripheral nerve-endings, although it depresses and paralyzes the central nervous system. Citations might be multiplied to show the host of inconsistencies and variations.

If such variations are found to be true for the action of drugs on the normal human body, how much more variable are the results of pharmacotherapy on the diseased organism. At times a given agent acts with less force on a diseased organ than on a healthy one; at times again with greater activity, and still further the action of a drug may vary widely in health and in disease.

At the present time the limits of present-day information offer but little hope for a better interpretation of these questions, and not only is the clinical side of the problem obscure, but the chemical side is equally uncertain. It seems that different chemical actions must be considered. Many compounds seem to react on protoplasm with a mutual disarrangement of the molecules; thus the action of strychnine is interpreted; others act on the tissues and are eliminated unchanged, and yet have probably altered the chemical character of the tissues acted on. Of late years, through the studies of followers of Nernst and Ostwald, an entirely new series of studies have been carried on which are destined to be closely related to the study of the physiological action of drugs. The study of electrolytic dissociation has already opened up new fields in physiology, and the ground is being broken in pharmacology. In the salts of the alkalies are found a series of actions differing from those already spoken of; here the active agent

induces changes in the watery content of the protoplasm or in the water of the liquids surrounding the cells, and brings about a series of physical, rather than chemical, changes. The familiar experiments of plasmolysis in the botanical laboratories illustrate this action, which is controlled by the general laws of diffusion of liquids, which are separated by animal or vegetable membranes.

In the animal body many salts are found in solution, not as complete molecules, but as made up of their electrical components, or *ions*, one positive and another negative, and when a chemical action takes place, it is an action not between the molecules of the salt and the protoplasm, but between an *ion* of the salt and the protoplasm, or even *ions* of the protoplasm molecule. For many of the simpler inorganic compounds, NaCl, KCl, KBr, KI, K(OH), many metallic salts, etc., the action of the *ions* is fairly well established. Thus the effects of strong, *hypertonic*, weak or dilute, *hypotonic*, and normal, *isotonic*, salt solutions on blood-cells, on muscle-cells, and on nerve-cells are well known and readily explicable under the now known laws of *ion* dissociation. Space does not permit of a more extended discussion of this interesting phase of the subject.

Physiological Action and Chemical Composition.—If the action of drugs is fundamentally a chemical one, then, on *a priori* grounds, it may be inferred that chemical compounds with similar dissociable *ions* will bring about similar physiological reactions. This general line of thought opens up a most fascinating field, which is daily offering more and more positive deductions, especially along the line of the newer synthetic preparations.¹

Many years ago Blake suggested and worked out a complicated scheme of the toxicity of the metals, based on the periodic law of Mendeljeff,² but it would seem, for the present, that the time has not yet come when such relationships will prove of any practical interest.

In the field of organic chemistry, however, the fundamental truths of the relationships of chemical structure and physiological action have given to pharmacotherapy some of its most highly prized drugs. The ingenuity of the pharmaceutical chemist is being taxed to the utmost in the search for new compounds.

¹ See Fränkel, *Arzneimittel Synthese*, 1901.

² He showed that between certain limits there existed certain relations between the molecular weights, the spectrum analysis, and the physiological action of the metals.

Along other lines equal diligence has been shown. Thus, a large number of the newer synthetic remedies have their drawbacks: their action is marred by certain unpleasant by-effects that have no relationship to the main action of the drug. Many are too readily soluble and exert a local action on the stomach, when it is desired that they reach the intestines; others are insoluble and do not act where it is desirable to have them do so—as, for instance, many of the intestinal antiseptics and astringents. Many other illustrations might be instanced.

One of the most fascinating problems connected with this subject is that of the combination of the useful activities of different synthetics. Thus it is possible to combine a hypnotic acting radicle with an analgesic, and in one compound get a combination of the two. Other desirable combinations naturally occur. It is unfortunate that this problem has been often accomplished very satisfactorily from the chemical point of view, but when the physiological test has been applied, the compound has been worthless, both actions having been lost by some modification of one or the other main action.

The possibilities of the problems are extensive, but the difficulties are many. One warning note should, however, be sounded. Notwithstanding the many excellent results that have been accomplished by pharmaceutical chemists, there seems to be a tendency on the part of many to offer to the medical profession a vast number of *so-called* new synthetics. These are not at all new, but are well-known old compounds or very slight modifications of popular compounds that do not differ at all in their main actions. Such, by dint of extensive advertising and ingeniously devised "clinical reports," they force on the practitioner as very valuable *new* synthetics. Reference is not here made to the imposition of the compounding of well-known remedies, such as acetanilid, etc., and the putting forth of the same under proprietary names as *new* synthetic compounds. Such are the sharks that prey upon the legitimate pharmaceutical chemist who is making honest efforts to give the profession much-desired remedies. They also prey on the community in that, under the guise of a secret name, they commit economic robbery, supplying at exorbitant rates what can be supplied anywhere at rational prices.

Relation of Physical Chemistry to Pharmacology and Therapeutics.—Perhaps no departments of medicine have been so sub-

ject to the criticism "unscientific" as those of pharmacology and therapeutics. Pharmacologists still hold the most contradictory positions regarding the action of specific drugs, and therapists have at their disposal but few means which enable them to predict with definiteness the course of disease. Our modern therapeutic nihilism is undoubtedly the reaction of a thinking medical profession against an antiquated empiricism. But, as is customary with such reactions, the pendulum has swung too far backward. In order to restore it to its right position it is necessary that we reconstruct our knowledge of pharmacology and therapeutics, and, by beginning with its simplest problems, slowly rebuild it upon a basis of newer interpretations more in accord with modern science.

It is impossible, in this limited space, even to touch upon all the points at which physical chemistry offers immediate results in its application to the problems of pharmacology. In these pages, therefore, we shall consider only the applicability of the theory of electrolytic dissociation to the problems in hand.

According to the dissociation theory of Arrhenius, when strong acids, bases, or salts are dissolved in water (or certain other solvents), either all or a part of the molecules are split by the water into simpler substances—the electrically charged atoms or groups of atoms known as "ions." Since these strong acids, bases, and salts upon solution conduct the electric current, they are known as "electrolytes." According to Arrhenius' theory, then, a solution of hydrochloric acid is made up not only of HCl molecules, but also of H-ions and Cl-ions. Similarly, a solution of sodium hydroxide contains not only molecules of NaOH, but also Na-ions and OH-ions. Ions are charged with positive or negative electricity. The negatively charged ions, which travel to the positive pole, are termed "anions"; those charged with positive electricity, and traveling toward the negative pole, are termed "cations." Thus the ions of a completely dissociated hydrochloric acid solution may be written H^+ and Cl^- .

We cannot here bring forward even a few of the facts that go to prove the truth of the dissociation theory of Arrhenius; but there are an abundance of the same to show that the chemical (and consequently the physiological, pathological, and pharmacological) effects of most of the electrolytes are entirely dependent upon their constituent ions, and are independent of the nature of the molecules. For example: hydrochloric acid dissociates into H-

and Cl-ions; NaCl dissociates into Na- and Cl-ions. These solutions are the same in so far as they both contain Cl-ions, but different in that one contains H- and the other Na-ions. These differences determine the differences in the properties of the two solutions.

A single experiment may serve to fix more clearly the fact that it is, indeed, the *ions*, and not the molecules, that determine the activity of an electrolyte in solution. If an iron nail is put into an aqueous solution of HCl, the iron is immediately attacked and H is liberated. If, however, the nail is put into a solution of HCl in benzene, no such chemical action takes place. The water in the first case converts the HCl into H- and Cl-ions. Benzene has practically no such dissociating powers, and the HCl remains in the molecular state. The molecules of HCl are incapable of attacking the iron.¹

It may, then, be accepted as true in general that the chemical characteristics of an electrolyte are dependent upon the nature of the ions contained therein. Thus the chemical characteristics of an aqueous solution of HCl are determined by the H- and Cl-ions it contains. All acids yield H-ions, and it is because of this fact that all acids have certain general properties. The differences between the solutions of two different acids that contain the same number of H-ions are determined by the differences between their anions. Since, now, the physiological effects of a substance are dependent upon its chemical nature, and since the chemical nature of an electrolyte is, in the main, dependent upon the nature of its ions, it follows that the physiological effects of an electrolyte are determined by the nature of its ions.

When an electrolyte is administered as a therapeutic agent, before it can produce any effect it must be in solution. Water is the universal solvent in the body. But when an electrolyte is dissolved in water, it is dissociated into ions. The therapeutic effects of such an electrolyte must, then, be dependent upon the ions which it yields. For example, in the administration of a dose of sodium iodide, we deal not with the effects of the NaI molecules, but with the effects of the Na- and I-ions into which the sodium iodide dissociates.

Although Dreser showed in 1894 that the relative toxicity of the mercury salts is determined by the number of Hg-ions that the salt yields upon solution in water, and although Kahlenberg

and True were the first to show that the poisonous effects of various electrolytes upon the roots of the bean are determined by the nature of their ions, the credit of recognizing the widespread physiological importance of the theory of electrolytic dissociation belongs to Jacques Loeb.

A series of papers originating from the laboratory of this investigator have brought proof of the following facts. The poisonous effects of acids and alkalies² upon muscle are determined by the number of the H- and OH-ions they yield, and is independent of the nature of the acid (in the case of the inorganic acids) or alkali. Another paper³ shows that the amount of water absorbed by a muscle from equimolecular salt solutions is influenced not only by the laws of osmotic pressure, but also by the nature of the ions in the solutions. The absorption of water from equimolecular solutions of sodium, potassium, and calcium salts by muscle is analogous to the absorption of water by the Na-, K-, and Ca-soaps, for while muscle absorbs but little water in the sodium solution, it absorbs an enormous amount in the potassium solution, while it actually loses water in the calcium solution. A most important contribution to our knowledge of life phenomena is found in the discovery that Na-ions are absolutely necessary for the production of rhythmical contractions in voluntary muscle,⁴ in heart muscle,⁵ and in the contractile swimming bell of the medusa.⁶ Yet a heart beating rhythmically in a pure sodium chloride solution soon comes to a standstill. If, however, a little calcium be added, the heart may continue to beat for hours.

What bearing, now, has the theory of electrolytic dissociation upon the problems of pharmacology? We have for years been accustomed to see the effects of different salts grouped under general headings. Thus we have become acquainted with the general effects of potassium and sodium salts, the salts of iron and lead, and the general properties of iodides and bromides. Never, however, has the question been asked, Why do these salts arrange themselves in such groupings? We have learned that certain salts having certain characteristics in common may at will be substituted for one another. We have known, moreover, that although certain groups of salts, such as the salts of Hg, Ag, Pb, Cu, etc., all have highly poisonous properties, yet that the fatal dose of the individual members of such groups differs greatly from one another. Then we have been impressed with the fact that many organic salts, or

salts combined with organic substances, are either entirely without effect, or else behave entirely differently from the ordinary salts. These are a few of the facts which become at once intelligible in the light of the dissociation theory.

We have said before that in the process of solution an electrolyte is dissociated, and that in consequence we deal, in the main, no longer with the properties of its molecules, but of the ions that constitute the molecules. We know, for example, that we can substitute, at will, sodium iodide for potassium iodide in order to produce certain therapeutic effects. These salts are alike in that they both yield I-ions; they differ in that the former yields Na-ions, while the latter yields K-ions. Any similarity manifested in the therapeutic effects of these two salts is determined by the similarity of their anions. But we know that the potassium iodide is much more depressant than the sodium salt. This is due to the direct poisonous effects of the K-ions upon muscle and nerves, an effect not exhibited by Na-ions. It is because all the iodides yield I-ions that they are grouped under a general heading. It is the effect of the I-ions that we seek in administering this drug in syphilis. Provided we give equal doses of I-ions, one salt may at will be substituted for the other. It is the secondary benign or deleterious action of the kations, however, which determines which salt we employ.

Similar reasoning applies to the bromides. We have long known of the hypnotic effects of the bromine salts and the specific effects of the bromides in epilepsy. These effects are due to the Br-ions, and one salt is as good as the other, provided it yields the same number of Br-ions, and its good qualities are not offset by a deleterious action of the kations. Experience with the bromides, moreover, brings to light the fact that it is indeed the *Br-ions* that determine the desirable effects of bromine compounds. Clinicians have long been acquainted with the fact that organic compounds containing bromine do not produce the effects given by the inorganic salts. This is because these organic compounds containing bromine do not yield any Br-ions at all, or because they yield only such small quantities as to be without effect in the doses administered. The same facts explain why manufacturers have been unsuccessful in producing an organic compound of bromine which could at all rival the ordinary inorganic salts.

The theory of electrolytic dissociation also explains why iron salts have certain general characteristics possessed by no other

salts, and why the salts of Hg, Ag, Pb, Cu, etc., are classed in groups by themselves. In these instances, however, the characteristic activity of the salt is determined by the kations, for the effects of the Hg-ions, Pb-ions, etc., evidence themselves long before the effects of the anions spring into prominence. In the cyanides, again, the anions are the effective agents and determine the characteristics of their group. KCN and HCN show similar effects, perhaps, because they both yield CN-ions, and these manifest their effects in doses so small that sight is lost of the K- and H-ions.

Several years ago Dreser⁷ showed that the toxic effects of mercury salts are determined by the number of Hg-ions they yield upon solution. When mercuric chloride is added to albumin a precipitate is formed which can be readily dissolved in sodium thiosulphate, forming a so-called complex mercury salt. When the mercury exists in this complex form it loses its toxic properties, and even though equal weights of the metal be present, the complex salt is unable to inhibit fermentation; and frogs, fishes, etc., poisoned with it instead of the sublimate die more slowly. Dreser finds an explanation for these phenomena in the fact that the double salt is either not dissociated at all, or yields only a small number of Hg-ions. In cold-blooded animals the salt is slowly decomposed, and the toxic effects of Hg-ions formed poison the animal. In warm-blooded animals the decomposition occurs much more rapidly, and in consequence not much difference was found between the toxic effects of the mercuric salt and its more complex derivative. Yet all local irritative manifestations were lacking in the latter case.

There have recently appeared upon the market various organic compounds of silver (protargol, nargol, etc.) which have come into general use as substitutes for silver nitrate. It seems that these compounds exhibit all the beneficent and only a few of the deleterious qualities of silver nitrate. Undoubtedly an explanation similar to that given by Dreser holds here too. Silver nitrate owes its specific action to the Ag-ions it yields. The organic silver compounds probably yield none or only a small number of such ions. When, however, the organic compound is introduced into the body, it is decomposed, and the Ag exerts its specific effects to a degree dependent upon the number of Ag-ions liberated. These facts explain the differences in the behavior between the organic and the inorganic silver salts.

Paul and Krönig,⁸ and, more recently, Scheurlen and Spiro,⁹ have been able to show that the bactericidal power of solutions of electrolytes is dependent upon the ions contained in them. Equimolecular solutions of mercury salts arrange themselves according to their degrees of electrolytic dissociation in the following order: HgCl_2 , HgBr_2 , $\text{Hg}(\text{CNS})_2$, HgI_2 , HgCy_2 . When arranged according to their bactericidal powers, the order is the same. This power is then dependent upon the number of Hg-ions contained in the solution. HgCl_2 , which contains the largest number, has the strongest germicidal action, while HgCy_2 , which is least dissociated, has the feeblest. So weak is the action of the cyanide that at a concentration four times that of a bichloride solution capable of destroying all cocci and spores it permits the development of several thousand colonies of the staphylococcus and many colonies of the anthrax bacillus. If K-ions are substituted for the Hg-ions by the substitution of KCl for HgCl_2 in the antiseptic solution, the germicidal powers of the solution are decreased, another fact which proves that the Hg-ion is the specific germicide. These facts effectively dispose of the conception of Behring, still held by many, that the bactericidal power of a mercurial is dependent upon the amount of *mercury* contained in it, and is independent of the nature of the compound.

The germicidal effects of silver and gold salts are similarly found to be dependent upon the Ag- and Au-ions. That it is, indeed, the ions which are thus effective is proved by the fact that solutions of HgCl_2 or AgNO_3 in absolute alcohol or ether (solvents in which but slight dissociation occurs) have no deleterious effect upon anthrax spores.

Recently Loeb^{10, 11} has pointed out the influence of the valency and possibly the electrical charge of ions upon their toxic and antitoxic effects. Previous experiments had brought to light the poisonous character of a pure sodium chloride solution for the development of fish embryos, or on the beat of the heart. But these toxic effects are done away with when a small amount of calcium is added to the sodium chloride solution. Thinking that these were only special instances of a more general law, Loeb investigated the toxic and antitoxic effects of ions upon the development of the eggs of *Fundulus*, a marine fish. The eggs of this fish develop equally well in sea-water (their ordinary habitat), in distilled water, or in sea-water the concentration of which has been raised by the addition of NaCl. In a pure sodium chloride solu-

tion, however, of the same concentration as that of the sea-water, not a single embryo develops. If, now, a small though definite amount of a calcium salt be added, the poisonous effect of the NaCl solution is annihilated, and the eggs develop into embryos. Not only is calcium able to bring about this effect, but any bivalent kation serves the same purpose—Ca, Ba, Mg, Fe, Co, and even Zn and Pb. The nature of the anion is immaterial.

But these facts hold not only for the poisonous effects of a pure NaCl solution, but also for the poisonous effects of solutions of other salts, of univalent kations with univalent anions—LiCl, KCl, NH₄Cl. From these experiments, then, the general conclusion may be drawn that a small amount of a bivalent kation suffices to annihilate the poisonous effects of the pure solution of a salt composed of a univalent kation with a univalent anion. It has been further shown that a trivalent kation may at will be substituted for the bivalent kation, and that a much smaller amount of a trivalent kation (Cr, Al) suffices to annihilate the poisonous effects of a pure sodium chloride solution than is required of the bivalent kation. Finally, a quantitative relation exists between the amount of the toxic salt and the amount of a bivalent kation necessary to annihilate its poisonous effects. With an increase in the concentration of the pure NaCl solution there is a corresponding increase in the minimal amount of the bivalent kation necessary to do away with its toxic effects.

These facts are of the greatest biological significance and of the most wide-spread applicability. A preliminary note announces that the valency and possibly the electrical charge of ions influence in a similar way the toxic effects of pure salt solutions upon muscle. The effect of a calcium salt in overcoming the poisonous effects of a pure sodium chloride solution upon the rhythmical contraction of a heart muscle strip becomes at once intelligible as a specific instance of the above-mentioned general law.

Loeb's experiments give us an insight, moreover, into the method by which ions possibly influence protoplasm. Some time ago he pointed out the fact that in dealing with the properties of protoplasm we are dealing, in the main, with the physics of a colloidal solution in which are dissolved certain salts. The experiments of Hardy have demonstrated most clearly the influence of the electrical charge of ions upon the physical state of colloidal

particles. It requires a large amount of a univalent ion to cause the coagulation of a colloid, but a small amount of a bivalent, or a still smaller amount of a trivalent, ion will accomplish the same purpose. Loeb believes that similar facts may possibly underlie the toxic and antitoxic effects of the salts. If the electrical charge determines the antitoxic effects of a kation, then it becomes at once apparent why a small amount of a bivalent, or a still smaller amount of a trivalent, positively charged kation suffices to neutralize the poisonous effects of a pure sodium chloride solution.

The theory of electrolytic dissociation is only one of the many developments of physical chemistry that promises much if applied to the problems of pharmacology or the biological sciences in general. We must attribute a large part of our present ignorance concerning the general laws that underlie the action of drugs to the failure to recognize and utilize the fruits of this new science. Innumerable papers still appear in which the physiological, pathological, and pharmacological effects of percentage solutions of various electrolytes are compared. Only chemically equivalent solutions can be compared. It is to such violations of the simple laws of physical chemistry that many of the erroneous results obtained in the biological sciences are to be attributed.

The action of electrolytes must be analyzed into the action of their constituent ions. Ultimately we shall have a classification of the electrolytes based upon the action of the ions contained in them. Once we grasp the notion that the activity of a given substance is determined by the ions it yields upon solution we shall, perhaps, find a method of rearranging our system of dosage upon this basis—a process analogous to the regulation of the dosage of crude drugs based upon their alkaloid content.

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MODES OF INTRODUCTION OF REMEDIES.

Remedies may be applied *externally* to the skin or *internally* to many mucous membranes, either as a *local* application or to bring about systemic action.

Methods of Skin Medication.—The passage of drugs through the unbroken skin takes place in a small degree only. The following methods are applicable: *Encutaneous method*, consisting of the application of cataplasms, fomentations, washes, vapor-baths, etc. *Epidermic methods*, or the methods of *inunction*; these are widely applicable. In such the drug is dissolved or suspended in some oily or fatty medium and made to penetrate the deeper layers of the skin by persistent and thorough rubbing. The thinner skinned portions of the body, such as the axillæ, groins, beneath the knee, and inner elbow surfaces are those most frequently used. The method is valuable for general absorption, especially in the mercurial administration for syphilis and in the use of methyl salicylate (oil of wintergreen) in rheumatism, but it lacks precision in dosage. *Endermic method*, by which the skin is blistered and the drug is applied to the free corium; it has many serious disadvantages.

Hypodermic Method.—This consists in injecting the drug into the subcutaneous tissues by means of the hypodermic needle and syringe. Since absorption by the tissues takes place readily, it will be seen that this method of application is far more efficacious than those previously mentioned. Not all drugs, it is to be observed, are available for administration by the hypodermic process of injection. The eminent success attending the operation, however, renders it of signal value to the physician.

This method was first used in a practical manner by Wood, of Edinburgh, in 1853. A syringe with glass rod and glass barrel accurately ground is the best now on the market. If carefully made, it will not leak and is never out of order. Those with metal barrels and leather washers dry out when not in constant use, and are never in condition when required. The all-glass syringe, moreover, can be sterilized at any time. This cannot be said of other varieties. A barrel holding about 30 minims is the usual size. After filling, all air should be excluded. The skin should be pinched up slightly, and the needle inserted rapidly and obliquely; some prefer to insert the needle at right angles, but this

is unnecessary, and if contaminated solutions should happen to be used, deep abscesses are produced. The insertion of the deltoid, outer aspect of the thighs, and deep muscles of the back are favorite sites. Solutions of drugs should not be used. It is preferable to use soluble hypodermic tablets; these are best dissolved in a teaspoonful of water heated over a flame; after cooling, the solution can be injected without causing pain. Prompt action follows this method, accurate dosage is assured, and disturbance of the gastric or intestinal mucosæ is avoided. As a rule, the dose by this method is 25 per cent. less than when given by the mouth.

Vaccination is a method of skin medication. In males it is best performed over the insertion of the deltoid, and in females there or at the upper outer portion of the leg. The thigh is troublesome to dress and necessitates greater exposure. For scarification the best instrument is a fine needle, which should be sterilized in a flame before using. The site selected should be cleansed thoroughly with soap and water; hard rubbing will aid in peeling away bacteria infected epidermis. Three or more scratches, $\frac{1}{8}$ of an inch apart and $\frac{1}{4}$ of an inch long, are then made, and the vaccine is rubbed in thoroughly either with a sterilized wooden toothpick or with the glass of a capillary tube. The capillary tube of glycerinated bovine lymph with a small balloon to expel the virus is the best form of virus now in use. With bovine virus the dangers from syphilis and tuberculosis are *nil*, and thorough cleansing of the arm avoids erysipelas or other septic infections.

Hypodermoclysis is a method of applying remedial agents through the skin. As a rule, 0.6 per cent. normal salt solution is used—a dram of table salt to a pint of boiled and filtered water. The site preferred is the anterior wall of the abdomen or the ilio-lumbar region, above the ilium and below the ribs. Thorough asepsis is necessary in the technic. An ordinary fountain syringe with a moderate sized needle is all that is required. The solution is best used at a temperature of from 110° to 115° F., and from 4 to 8 ounces are employed. The method is extremely useful in conditions of shock, hemorrhage, diarrhea, uremia, and in toxic states generally.

Local Applications to Mucous Membranes.—*The Eye.*—Here lotions (collyria) of boric acid or hot water are applied. Ointments and caustics are applied directly. Calomel may be dusted into the eye for sluggish chronic inflammatory conditions.

The Ear.—This is reached by direct application, or by means

of syringe. Alcoholic solutions of mild antiseptic drugs, such as boric acid, may be employed, the evaporation of the menstruum depositing the antiseptic in place. The ear is also reached by the Eustachian catheter from the inside.

The Nose.—Direct application of caustics or astringents can be made to the nose. Sprays and insufflations of antiseptic solutions or powders are useful. For children one of the most efficient methods of cleansing the posterior pharyngeal vault, which often is necessary in scarlet fever, measles, influenza, etc., in order to avoid middle-ear infection, is to let the little patient lie on his back, and, by means of a tablespoon, the antiseptic solution can be placed directly in the nose. Children will permit, even enjoy, this, when no amount of coaxing will persuade them to submit to the use of a spray. Moreover, a spray rarely cleanses the entire nasal cavity.

The Pharynx is reached best by direct application of absorbent cotton on an applicator. The applicator is made capable of being bent so as to reach the posterior pharynx. Solutions of cocaine, 4 per cent, and freshly prepared solutions of suprarenal gland, 10 to 50 per cent., are widely employed as local applications for anesthetic and astringent purposes in these localities. Gargles are now largely superseded by direct applications, sprays, or by syrupy or mucilaginous solutions containing astringent drugs.

Respiratory Tract.—As a means of producing anesthesia the respiratory tract has been utilized for some time. Opium is also taken in this manner by the opium-smoker. The confirmed cigarette inhaler also utilizes the respiratory tract. In young children breathing of steam, medicated or not, is an efficient means for treating spasmodic laryngitis, bronchitis, and bronchopneumonia. It is probable that the breathing of medicated vapors, as advocated by the disciples of the pneumatic cabinet, as a means of treating tuberculosis of the respiratory passages is largely illusory.

Rectum.—Medication as well as feeding by means of the rectum is indicated in conditions of great irritability of the stomach or under special circumstances, such as stenosis of the esophagus, gastric cancer with stenosis of the cardiac entrance, hysterical dysphagia, or in certain insane states, notably melancholia. Local disease may require local application of cautery, astringents, etc. By means of the proctoscope, enteroscope, or rectal specula, such topical applications may be made with ease and precision. Before making use of the rectal mucous membrane as a means for absorption it should be cleaned thoroughly. The alkaline reaction of the

mucus should be remembered in prescribing, else incompatibility may easily arise. Most drugs are absorbed much less rapidly through the rectal wall than through the stomach; there are, however, a few exceptions. These are notably strychnine, morphine, and iodine. Such is the teaching of many modern text-books. Personally, I have not been able to verify this.

Enteroclysis, or intestinal hydrotherapy, as one author puts it, is a method of intestinal irrigation, including the use of enemata, used for the relief of a variety of conditions. It is a highly valuable procedure. Any syringe will suffice, but for large quantities of water, the fountain or bag syringe is perhaps best adapted.

Large quantities of fluid may be thrown into the bowel—as much as 9 pints may be used. If the temperature of the fluid is high,—115°–118° F.,—there is less tendency to the development of intestinal cramps. When a large quantity of water is used to irrigate the bowel, its course may be followed by percussion, and its descent into the ascending colon noted. In this manner the cecum can be reached and thoroughly cleansed, a procedure of much value in the medical treatment of appendicular disorders. Normal salt solution may be used to subserve the same purposes as by hypodermoclysis.

Urethra.—Here direct application, irrigation, and suppositories afford the best means of medication. The cystoscope may be used here or for direct applications to the walls of the bladder.

Stomach.—Medication by means of the stomach is the most convenient and practical method. The passage through the mouth and esophagus does not alter, to any great extent, the principles of drugs. Some drugs, such as strong acids, must be well diluted in order to protect the mucous membrane of the mouth and the enamel of the teeth. The administration of certain of the metals requires caution. Thus, some of the soluble iron preparations alter the color of the teeth somewhat; lead acts injuriously if the teeth are carious; and when mercury is being administered, the hygiene of the mouth must be carefully watched. In the stomach many drugs that are insoluble or slightly soluble in water are rendered more soluble by the weak acids; many chemical reactions take place, which are further complicated as the drugs pass into the intestines and meet the alkaline fluids, the bile salts, and the products of intestinal digestion.

Intravenous Injection may be resorted to in desperate cases: its dangers are obvious, however, and, save for the purpose of trans-

fusion after severe hemorrhage, it can seldom be attempted with impunity.

Internal Administration.—The most obvious, and by far the most useful, method of internal administration is by the *mouth*; yet care and discretion are to be used even in so ordinary a process, and the physician should consider thoughtfully the time, consequent effects, and chemical changes, that the drug may produce the most beneficial results.

Inhalation is in many respects of the first importance as a method of internal administration. Its great facility in practice and its unquestionable efficiency—as in the case of anesthetics—render it readily available and highly beneficial, although the method has attained as yet only a limited use in therapeutics beyond a resort to it in pulmonary diseases.

Enemata—A different class of administrative operations consists in injections into the rectum, which injections may be purgative, anodyne, nutrient, emollient, astringent, anthelmintic, etc. For speedy and efficient cleansing of the large intestine the purgative enema is of incomparable value, care being taken that the quantity of the injection be sufficient, that it be passed up as far as possible, and that it remain as long as the patient is able to retain it.

Nutrient enemata may be employed when, for any reason, the food cannot be made either to enter the stomach or to remain there. Small quantities—3 or 4 ounces—are retained better than larger amounts. As the mucous membrane of the rectum does not have any digestive power, such enemata should be predigested, either by peptic or pancreatic ferments. Milk, oatmeal, gruel, oysters, eggs and milk, peptonized, with mild alcoholic additions, as of sherry, make excellent nutrient enemata.

Another mode of securing beneficial results from internal administration through the absorptive properties of the intestine is by means of *suppositories*, readily introduced within the sphincter and dissolving at the temperature of the body. This method of medication is serviceable either for local or general purposes.

To take the place of intravenous injection, normal solution, 0.6 of 1 per cent, is used as an enema in all conditions where the former is indicated, especially after major operations. From 7 to 17 fluidounces (207–503 Cc.) are injected, according to the individual tolerance of the patient. These injections are to be repeated in the endeavor to secure the absorption of from 2 to 6 quarts (liters) of the solution in the course of twenty-four hours.

Conditions Modifying the Action of Remedies.—All individuals are not affected in the same degree by the same remedy. Age, size, weight, fatness or leanness, sex, temperament, etc., are some of the variants. These may be considered under the general head of dosage.

Dosage.—The term *dose* implies the quantity of a medicinal agent which under certain conditions it is advisable to administer. In other words, the therapeutic dose is that portion of a medicament which is capable of producing the required action. There are many considerations entering into the question, to be weighed by the features of the individual case. Dosage may be regarded as perhaps the most vulnerable point in therapeutic science, yet one upon which the art of healing almost wholly depends. While it yet seems advisable to state in a text-book the so-called *maximum* and *minimum* doses of various drugs, clinical experience has convinced me that the principle of the *maximum* and *minimum* should not be considered the true rule for dosage.

Common sense ought long since to have told us that the doses prescribed in the text-books are only based upon experience in certain cases, or upon experimentation made upon animals. From such data, however, the first author who wrote upon the posology of different substances started, and others have simply copied after the first. If any fact went beyond the well-defined limits, it was wont to be explained by the defective quality or method of preparation of the drug, or by an idiosyncrasy so rare that one would not even take the pains to investigate the matter and see if it were really less rare than had been believed.

Since Heller in 1755 enunciated his philosophical maxims touching the rational method of testing the therapeutic effects of drugs, eminent clinicians have sought to solve the mysteries attending the action of various remedies whose *modus operandi* remains to this day obscure. Indeed, so great is the diversity of operation pertaining to the commonest remedies, conditioned by the character and circumstances of the case, as well as the amount and quality of the drug, that it is next to impossible to predicate the precise effects of agents whose physiological properties are theoretically and even practically established. The ordinary adult dose of opium, for instance, is 1 gr. (0.06 Gm.); yet in certain diseases, such as peritonitis, ten times that amount may be required to relieve the pain. The doses given in many text-books differ materially from those prescribed in actual practice, being in-

tended to express only the average quantities to be administered, the exact amounts varying with the conditions of the particular case. These conditions may be classed under the heads of age, sex, temperament, idiosyncrasy, habit, state of the system, temperature of the body, time of administration, intervals between doses, cumulative action of the drug, and the contingent considerations of diet, climate, race, etc.—oftentimes a complicated problem even to the most skillful therapist. A few suggestions regarding the leading characteristics of dosage, as limited by these various circumstances, may be of value to the student.

The influence exercised by *Age* is indubitable, as a rule the young requiring smaller doses than adults, the very aged may be also very susceptible. With regard to children several mathematical formulæ have been devised, none of which, however, has proved infalible—least of all those based upon adult dosage, itself subject to no little uncertainty. Nor can deductions as to the efficacy of a given dose be drawn from the action of drugs with which the agent is naturally associated. A single drop of laudanum has been known to produce the death of an infant, whereas large doses of belladonna, conium, arsenic, and mercury have been taken with comparative impunity.

The most convenient rule (Young's) adds 12 to the child's age and divides by the age to get a denominator of a fraction whose numerator is 1, this fraction representing the proportion between adult and infant doses. Thus, for a child three years old $\frac{1}{3} \times \frac{12}{3} = \frac{1}{3}$, 5, or $\frac{1}{5}$, the dose being one-fifth of that given to an adult.

Temperament acts as an important agent in modifying the effect of medicinal remedies, phlegmatic subjects readily tolerating certain medicines, such as opium, which those of nervous temperament are unable to bear. Stimuli act upon sanguine patients forcibly, yet upon others their influence may be either tardy or ineffectual. The condition is one which discloses a wide field of inquiry, the mental, moral, and physical tendencies of the individual being involved in the practical administration of medicines.

Closely allied to the foregoing is the question of *Idiosyncrasy*, the constitutional peculiarity which exerts a subtle influence, scarcely understood, as potent as it is obscure. Its characteristics cannot be formulated, but must be studied with the aid of experience—an odor, a taste, a casual or fixed impression, or hereditary instinct often determining their existence and manifestation. In tempera-

ment and idiosyncrasy, indeed, the psychological rather than the physiological side of therapeutics is developed, requiring for its treatment a professional acumen not always at command.

The influence of *Habit* is to diminish the susceptibility of the organism to impressions which under normal conditions would be speedy and effectual. Only by gradually increasing the quantity of the dose can results be obtained which in ordinary circumstances require few exhibitions. Thus, patients accustomed to the use of alcoholic stimulants accept heroic doses of alcohol with little or no indication of the effects quickly perceptible in temperate subjects.

Bodily condition obviously affects the action of remedial agents. It is well established that in severe pain opium may be administered in quantities which in a healthy organism would produce untoward, perhaps fatal, results. The salivation occasionally caused by mercury is seldom apparent in febrile conditions. Yet in cases where sensibility is diminished great care is necessary to avoid the deleterious effects of over-stimulation or excessive dosage.

Tolerance is closely associated with habit. There may be a specific tolerance of the nature of an immunity. Thus, rabbits are known to be very resistant to belladonna, hogs to snake venom, etc. Acquired tolerance is repeatedly seen for tobacco, alcohol, and opium, and certain recent studies have attempted to show that substances related to immune bodies are elaborated by the organism, thus in part explaining the phenomena of acquired tolerance.

Respecting *Sex*, although it is generally admitted that females require smaller doses than males, the exceptions to the rule are so numerous as almost to vitiate the accepted theory.

The *Time of Administration* is closely connected with the *Form of the Remedy* given, as a rule remedies being withheld immediately before and after meals. The practice, however, is subject to modifications, certain drugs acting best on an empty stomach, and others, such as local irritants, being more safely diffused when the stomach is full, in which case by mingling with the food they are not brought into irritating contact with the intestinal mucous membranes.

With regard to *Intervals between Doses* it may be said, in brief, that they are to be determined by the special features of the case, the character and potency of the drug, and the degree of tolerance and assimilation evidenced by the patient. Every remedial agent, under normal conditions, produces a specific and definite action, the system by absorption and elimination limiting the period of its efficacy in cases of prolonged treatment, so that the drug is evi-

dently to be renewed in order to secure perfect results. Failure to continue treatment has frequently proved disastrous, even fatal, to the patient, and it should be borne in mind that, in the absence of contraindications or untoward effects, a primary object of dosage is to create and maintain an impression upon the morbid system.

Repeated dosage with tardy elimination may lead to *cumulative action*. Thus, while dose for dose ethyl alcohol is more toxic than methyl alcohol, repeated doses of methyl alcohol are more highly poisonous, from slow elimination, than doses of ethyl alcohol. The chronic poisoning by the heavy metals, arsenic, mercury, or lead, is an illustration of a type of cumulative action. The iodides and bromides show similar phenomena. Digitalis is a classical example.

Other considerations—by some therapeutists held to be of minor, by others of paramount, importance—affect the vital question of dosage. The emotions, for example, play an interesting part in the toleration or rejection of remedial agents. Strangely enough, too, the imaginative faculty is often a cause of idiosyncrasy, numerous instances being adduced by reputable authorities wherein either positive or fancied ills were affected through the agency of spurious remedies—bread-pills, deceptive concoctions, and the like—the ethical aspect of therapeutics being here left to the conscience of the physician.

Pathological states are important modifiers of drug action. Thus, in chronic nephritis drugs which do not modify the kidney epithelium are used. Effort is made to obviate such activities. In high temperature the many synthetic antipyretics act very rapidly while having very little effect in health. In the case of parasitic diseases such as trypanosomiasis or malaria, the action of trypan-red or of quinine is naturally and entirely a different action than when given to a healthy person. In certain intestinal diseases associated with acid diarrhea, and with diminished alkalinity of the intestinal canal, the use of synthetic remedies which are only broken down into their constituent parts by alkalis is obviously useless.

UNTOWARD EFFECTS OF DRUGS.

Drugs given a specified patient, a victim of acquired or inherited defect, will produce in that patient unexpected results differing from their usual action. These results, which should not be

classified with typically poisonous effects or with those of prolonged use, may not appear in many cases, and do not correspond, as a rule, with the admittedly poisonous symptoms. They have been termed in Germany "*nebenwirkungen*," in France "*inconvenients thérapeutiques*," and among the English-speaking nations "untoward effects" and "bye-effects."

Untoward effects are of great interest from a medico-legal standpoint. Even physicians are but too apt to refer them to defects or impurities in the drug dispensed. They are seemingly multiform in character, and yet they can readily be ranged under a few general laws. The primary and secondary effects, which are often opposite in nature, the organs chiefly affected by the ordinary action of the drug, the method of drug-excretion, all play a part in what may be called general constitutional untoward effects, as contrasted with the untoward manifestations due to temporary and evanescent conditions, which last, however, also range themselves in a regulated fashion.

Prediction may be made with considerable accuracy as to the untoward effects of any drug on learning its action and all the factors cited. An antipyretic will have as untoward effects, skin-eruption because it is excreted through the skin, because the skin through its pores regulates temperature, and hence is under control of the central nervous system regulating temperature, and, finally, because the skin is in close connection from an early period with the nervous system. For the same reason profuse, debilitating perspiration often results. Since control of the temperature cannot be effected without control of the vasomotor system regulating the blood-supply, heart-failure, collapse, and palpitation may result, together with certain eye- and ear-symptoms.

The action on the heart may, by its influence on the kidney circulation, cause kidney and bladder symptoms even to the extent of albumin in the urine. If a remedy be excreted through the kidneys, albuminuria may present itself as an untoward result as is sometimes the case with ether. Alteratives and purgatives produce hemorrhages from the mucous membranes and swelling of those of the organs of special sense, beside skin-eruptions. Some hypnotics produce excessive perspiration, skin eruptions, vertigo, and heart collapse. Astringents cause diarrhea and bloody intestinal discharges. Diaphoretics cause pains at certain points from over-stimulation. Pilocarpine causes at times pain in the penis; as there often occur in certain persons excessive secretion and plugged

sebaceous glands around its head, the pain and other resultant symptoms simulate chancre.

It will be observed from the annexed tables (see pages 52-57) that the most potent tonics and alteratives are most fertile in untoward effects. This is naturally to be expected. A drug of potent physiological action must of necessity try more severely inherited and acquired deficiencies of constitution than an inert drug. Too excessive strain on inhibitions weakened by acquired or inherited taint gives an undue sway to inhibited centers. Untoward effects of drugs may hence be conditioned on pre-existing affections of the inhibitory apparatus of the system.

One influence which, together with hereditary or acquired defect, plays a part in determining untoward results is what the Germans call the "etiologic moment." This is excellently illustrated in the neurotics, which display such decidedly variable untoward effects. In many neuroses nerve-strain of the eliminative and assimilative organs has produced toxins and other products; some of these naturally add to the effects of a given neurotic drug, or direct these in some special channel or inhibit certain effects, thereby giving others undue play. This may constitute, as Lewin has shown, a disposition that is but temporary, which disposition may have its foundation either in a greater abundance in the system of bio-chemical substances, which cause an unusually prompt solution or action of the medicines introduced, or which may unite with them to form injurious compounds; or it may be conditional on pre-existing pathologic changes in the inhibitory apparatus of the system.

The tables given on pages 52-57, covering all the departments of the *materia medica*, will give a better idea of these untoward effects than any detailed description.

TABLE I.

	GENERAL	HEAD AND CORD	EYE, EAR, AND THROAT	Skin	LIVER, KIDNEYS, AND BLADDER
Arsenic	Fever, gastralgia, nausea, hematemesis, salivation, profuse sweating, diarrhoea, purpura	Vertigo, stanic symptoms, local anæsthesia	Lived edema, glottis edema, catarrh, amygdalitis, tonsillitis	Vesicles, pustules, papules, erythema, urticaria, purpura	Dysuria, icterus, hematuria, glycosuria, cystitis, albuminuria
Chelidonium	Nausea	Vertigo	Tinnitus	Pruritus	Albuminuria
Cod Liver Oil	Nausea	Vertigo	Lake guanine	Vesicles	Cystitis, strangury.
Cocculus	Nausea, gastralgia, like guanine	Lake guanine		Vesicles	
Columbo	Fever	Vertigo, contractions	Conjunctivitis, tinnitus	Erythema	Dysuria
Croton	Fever, nausea	Vertigo, emotional exaltation, aphrodisiac	Excidid edema, tinnitus	Erythema, papules, erythema, papules	Cystitis
Cuba	Fever, profuse sweating	Vertigo, stanic symptoms, neuralgia	Glottis edema, tinnitus	Vesicles	Cystitis, strangury.
Iodine	Bulimia, gastralgia, catarrh, diarrhoea, hemoptysis, dyspnoea, fever	Aphrodisiac, ataxic symptoms, vertigo, delirium	Amblyopia, catarrh, glottis edema, excidid edema, dyspnoea, tinnitus, salivation	Erythema, vesicles, papules, pustules, purpura, eruptions, urticaria	Dysuria, cystitis, glycosuria, albuminuria
Iron	Emptiness, nausea, hemoptysis, hematemesis, nausea, gastralgia, fever, diarrhoea, constipation	Vertigo, stanic symptoms, insomnia	Excidid edema, glottis edema, amblyopia, tinnitus	Vesicles, purpura, eruptions	Hematuria, albuminuria, glycosuria, icterus
Mercury	Fever, gastralgia, diarrhoea, constipation, leucorrhœa	Insomnia, ataxic symptoms, insanity, local sensory troubles	Eyelid edema, amblyopia, tinnitus, glottis edema	Lake iodides and quinine, tongue ulceration, salivation	Dysuria, cystitis, hematuria, glycosuria
Quina	Nausea	Vertigo, contractions	Tinnitus	Papules	Dysuria
Quinine	Fever, nausea, bulimia, hemoptysis, profuse sweating, dyspnoea	Delirium, insanity, ataxic symptoms, local sensory troubles, sensory troubles, vertigo	Amblyopia, pharyngitis, deafness, tinnitus	Stomatitis, scarlet fever, vesicles, papules, pustules, erythema, urticaria, purpura	Hematuria, cystitis, albuminuria, glycosuria, icterus
Sulley Acid	Profuse perspiration, bulimia, hemoptysis	Vertigo, delirium, insanity, ataxic symptoms, local sensory troubles	Dim sight, deafness, tinnitus	Vesicles, pustules, pruritus, gangrene, purpura	Cystitis, glycosuria, icterus
Succaparilla	Nausea, gastralgia, bulimia, profuse sweat	Vertigo, stanic symptoms	Glottis edema, tinnitus	Eczema	Cystitis, strangury.

TABLE II.

	GENERAL. LUNGS AND HEART.	BRAIN AND COORD.	EYES, EARS, AND THROAT.	SKIN.	LIVER, KIDNEYS, AND BLADDER.
Strychnine	Fever, dyspnea.	Vertigo, ataxic sym- ptoms, local sensory troubles.	Conjunctivitis, photo- phobia, tinnitus.	Erythema, pruritus.	Albuminuria, glycosu- ria, cystitis.
Turpentine	Fever, nausea.	Vertigo, drowsiness, stupor.	Tinnitus.	Vesicles, erythema.	Albuminuria, cystitis, strangury, hematuria.
Acetanilid	Cardiac failure, lung edema, cyanosis, fe- ver, pallor, hyperidro- sis, nausea, diarrhe- a.	Anesthesia, hyperes- thesia, vertigo, delir- ium, stupor, ataxia.	Amblyopia, xerostoma, throat constriction, tinnitus, pupil irregu- larity, conjunctivitis.	Erythema, vesicles, pap- ules.	Icterus, dysuria, cystitis, albuminuria, glycosu- ria.
Aconite	Nausea, diarrheal, sali- vation, hyperidrosis, collapse, cyanosis.	Vertigo, anesthesia, hyper- esthesia, hyperes- thesia.	Amblyopia, tinnitus, xerostoma.	Erythema, urticaria.	Icterus, polyuria.
Amyl Nitrite	Like glonoin.	Like glonoin.	Like glonoin.	Like glonoin.	Like glonoin.
Antikamnia	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid.	Like acetanilid.
Antipyrin	Cardiac weakness, pallor	Anesthesia.		Erythema.	
Arnica	Tenesmus, bradycardia, diarrhea, collapse.	Stupor, vertigo, head- ache	Xerostoma, amblyopia, throat irritability.	Erythema, urticaria, papules, pruritus.	Cystalgia, dysuria.
Atropine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Belladonna	Diarrhea, nausea, vom- iting, collapse, hyper- idrosis, fever, cardiac pain, dysphagia, dysp- nea.	Delirium, insanity, stu- por, vertigo, ataxia.	Amblyopia, lachryma- tion, xerostoma, tin- nitus.	Erythema, vesicles, pap- ules, purpura, pruri- tus.	Cystalgia, dysuria, poly- uria.
Bromides	Collapse, cardiac failure, lung edema, gastral- gia, vomiting, aphro- disia, amenorrhea, pneumonia.	Delirium, insanity, stu- por, ataxia, convul- sions, anesthesia, hy- peresthesia.	Throat anesthesia, co- rryza, laryngismus stridulus, conjunctivi- tis, amblyopia, my- opia, diplopia, fetid breath.	Acne, papules, vesicles, urticaria, erythema, pruritus.	Dysuria, cystalgia, ic- terus, polyuria, glyco- suria.
Caffeine	Bradycardia.	Delirium, insanity.	Diplopia.	Erythema, vesicles.	Dysuria.
Camphor	Diarrhea, collapse, aph- rodisia, hyperidrosis, vomiting.	Delirium, insanity, stu- por, hyperesthesia, headache.	Xerostoma, coryza, am- blyopia, tinnitus.	Erythema, vesicles.	Dysuria, polyuria, cys- talgia, strangury.

TABLE II. (Continued).

	GENERAL LUNGS AND HEART	BRAIN AND CORD	EYE, EAR, AND THROAT	SKIN.	LIVER, KIDNEYS, AND BLADDER
Cannabis Indica . . .	Apnoea, vomiting, diarrhea, rhea	Vertigo, delirium, in- sanity, ataxia.	Amblyopia, tinnitus.	Erythema, vesicles.	Dysuria, cystalgia.
Chloralamid (Chlorose) Chloral Hydrate . . .	Like chloral. Like chloral. Dyspnea, lung edema, heart failure, diarrhea, hypotension, bradycardia	Like chloral. Like chloral. Vertigo, ataxia, stupor, delirium, convulsions anesthesia, hyperesthesia	Like chloral. Like chloral. Epiglottis edema, am- blyopia, photophobia, conjunctivitis, cho- roiditis, tinnitus.	Like chloral Like chloral Erythema, acne, purpu- ra, papules, urticaria, pruritus.	Like chloral. Like chloral Icterus, dysuria stran- gury, glycosuria, al- buminuria.
Chloroform	Fever, collapse, apnoea, diarrhea, dyspnea, hy- peridrosis	Vertigo, delirium, ataxia.	Amblyopia, like chloral.	Like chloral.	Like chloral.
Cocaine	Anaphrodisia, collapse, diarrhea, constipa- tion, nausea, fever, amenorrhea, tenes- mus	Vertigo, ataxia, hyper- esthesia, delirium, in- sanity.	Like opium	Like opium.	Icterus, strangury, dys- uria, polyuria.
Codeine	See Opium	Ataxia, stupor, hyper- esthesia	Amblyopia.	Erythema.	Dysuria, polyuria.
Conium	Nausea, vomiting, bra- dycardia	Headache, vertigo, stu- por, insanity, ataxia.	Amblyopia.	Erythema.	Dysuria polyuria, stran- gury, glycosuria.
Digitalis	Cardiac failure, dysp- nea, dyspnoea, nau- sea	Convulsions, vertigo ataxia, hyperesthesia, delirium insanity.	Amblyopia, tinnitus, photophobia.	Erythema, papules, urti- caria.	Icterus, glycosuria, strangury.
Doibosine	See Belladonna	Vertigo, delirium.	Salivation, laryngismus stridulus, amblyopia, tinnitus	Erythema, urticaria.	Icterus, glycosuria.
Ergot	Nausea, vomiting, gas- tralgia, bradycardia, fever, cyanosis.	Like acetanilid. Vertigo	Like acetanilid. Amblyopia.	Like acetanilid Erythema.	Like acetanilid Strangury, icterus.
Ether	Pallor, cyanosis.	Vertigo, ataxia, analge- sia.	Amblyopia.	Erythema.	Strangury glycosuria.
Eucalypt	Like acetanilid				
Gebemum	Dyspnea, coryza				
Glonoin	Dyspnea, coryza				

Holocalbe	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Homatropine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Hydracetin	Fever, nausea, cardiac irritability, dyspnea, nausea.	Vertigo, delirium, ataxia, numbness.	Pupil immobility, amblyopia, conjunctivitis, throat irritability.	Erythema, purpura.
Hyocyanus, } Hyocyamine, } Hyoscyne	Like belladonna.	Like belladonna.	Like belladonna.	Erythema, papules, and pustules.
Kryoline	Dyspnea, coryza, hyperidrosis.	Like hydracetin, except as to delirium.	Amblyopia.	Erythema.
Methylal	Like kryoline.	Like hydracetin, stupor.	Diplopia, amblyopia.	Erythema, urticaria.
Methacetin				
(like acetanilid).				
Monobromacetanilid	Fever, syncope, hyperidrosis, cyanosis.	Vertigo, stupor, headache, numbness, hyperesthesia.	Amblyopia.	Like methylal.
Musk	Nausea, aphrodisia, fever.	Like monobromacetanilid.	Throat irritability, amblyopia.	Dysuria.
Opium, } Morphine, } Codeine, }	Nausea, diarrhea, gastralgia, dyspnea, aphrodisia, fever, hyperidrosis.	Vertigo, stupor, convulsions, insanity, headache, paresthesia.	Throat irritability, amblyopia, yellow vision, accommodation spasm.	Dysuria, glycosuria, leterus.
Paraldehyde	Like alcohol.	Like alcohol.	Like alcohol.	Like alcohol.
Fenial	Like ether.	Like ether.	Like ether.	Like ether.
Phenacetin	Fever, collapse, dyspnea, hyperidrosis, cyanosis.	Vertigo, ataxia, stupor, hyperesthesia.	Amblyopia, tinnitus, diplopia.	Dysuria, glycosuria, leterus.
Phenocol	Like phenacetin.	Like phenacetin.	Like phenacetin.	Like phenacetin.
Phyostigma	Nausea, gastralgia, vomiting.	Vertigo, mastalgia, delirium, ataxia.	Tinnitus, amblyopia.	Dysuria, leterus.
Phytolacca	Like phyostigma.	Like phyostigma.	Like phyostigma.	Dysuria.
Pulsatilla	Coryza, dyspnea, cardiac irritability.	Orchialgia, mastalgia.	Amblyopia, eye-pain, tinnitus.	Dysuria, polyuria.
Scopolamine	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Stramonium	Like belladonna.	Like belladonna.	Like belladonna.	Like belladonna.
Sulphonal	Like alcohol.	Like alcohol.	Like alcohol.	Like hematuria.
Tetronal, } Trional, }	Like sulphonal.	Like sulphonal.	Like sulphonal.	Like sulphonal.

Ialap	See <i>Colocynthis</i> .	Vertigo, ataxia.	Amblyopia, tinnitus.	Erythema, roseola.	Dysuria, cystalgia.
Male Fern	Nausea, fever.	Vertigo, ataxia.	Amblyopia, tinnitus.	Erythema.	Polyuria.
Podophyllum	See <i>Colocynthis</i> .	Vertigo, delirium, ataxia.	Amblyopia, coryza, epistaxis.	Roseola, erythema.	Nephritis, icterus, cystitis, dysuria.
Pomegranate	Nausea, diarrhea.	Vertigo, delirium, ataxia.	Amblyopia, coryza, tinnitus.	Roseola, maculae, erythema, urticaria.	Hematuria, dysuria.
Pot. Chlorate	Nausea, diarrhea, fever.	Vertigo, ataxia.	Amblyopia, deafness, tinnitus.	Macules, erythema.	Dysuria, cystitis.
Rhubarb	Nausea, vomiting, constipation, penis hemorrhage.	Vertigo, delirium, ataxia.	Amblyopia, photophobia, yellow vision, tinnitus.	Erythema, urticaria.	Icterus, dysuria.
Rhus	Nausea.	Vertigo, ataxia, insanity, delirium.	Amblyopia.	Erythema.	Dysuria.
Santonin	Nausea, diarrhea, gastralgia, amenorrhea.	Vertigo.	Xerostoma, amblyopia, coryza, tinnitus.	Erythema.	Dysuria, hematuria.
Senega	Nausea, diarrhea, gastralgia.	Like senega.	Amblyopia, conjunctivitis.	Roseola, papules.	Nephritis, cystitis, dysuria.
Squills	Like senega.	Vertigo.			
Tartar Emetic	Nausea, cyanosis, collapse.	Vertigo.			
(antimony).					

CLASSIFICATION OF MEDICINES.

THE classification of drugs and remedial agents is a theme regarding which the many writers upon and teachers of medicine have shown a wider diversity of opinion, perhaps, than upon the physiological action and medical uses of individual remedies. The fact that therapeutics is far from being an exact science, and the rapid advance in our knowledge of normal physiological processes, of pathological conditions, and the systematic action of drugs, are sufficient explanation of the ever-changing judgments of our best observers concerning the action of certain medicinal agents under given conditions.

It follows that from time to time, as appears in reviewing the literature of the subject, different writers, in their attempt to keep pace with the advancement of knowledge, have devised various systems of classification.

In earlier days, when the therapist culled from the fields his simples for the cure of disease, there was naturally created a strong tendency toward a botanical classification. So far was the system pushed that in certain so-called schools of medicine the authority of Scripture was invoked, it being proclaimed as an axiom that "the leaves of the tree were for the healing of the nations" (Rev. xxii. 2). This eclecticism, strange as it may seem to-day, was the outgrowth of the Thompsonian or Botanical system of therapeutics. On the other hand, as an evolution of the old alchemic school, an attempt was made to found a classification by explaining the remedial action of all medicines upon a purely chemical basis.

With the advent of more modern methods of study, applied to the physiological action of drugs upon the animal economy, came the physiological classification, in which the effects of remedial agents were explained upon rational grounds.

It is hardly necessary to state that coexistent with these various endeavors to attain a philosophical method of classification, complicating them and perplexing their votaries, the dominating principle of empiricism held universal sway, setting at defiance in many instances the cardinal maxims of rational therapeutics, the rational therapist even to-day welcoming as a last resort the cruder, though often efficient, empirical method.

Some authors, perceiving the inutility of the older systems, have contented themselves with a mere alphabetical arrangement

of medicinal agents, regardless of their origin, natural affinities, mode of preparation, and physiological action.

Taking all the conditions into consideration, it seems the wisest plan for beginning students of medicine to so arrange the various drugs in use as far as possible along lines of therapeutic efficiency; and inasmuch as the trend of modern therapeutics is becoming more and more physiological, a combination of the physiological and therapeutic systems is here adopted. Many inconsistencies are inevitable in any classification, yet such a method of grouping is deemed the most satisfactory for students and practitioners alike.

WEIGHTS AND MEASURES.

THE history of Weights and Measures affords a striking example of the incongruity resulting from the absence of a uniform standard of stable value to science, and must be regarded as the strongest argument in favor of the Metric, or Decimal, System.

An idea of the confusion prevailing under the old methods may be gained from an examination of their comparative units, by which we find that a pint is not a pound, an ounce not equal to a fluid-ounce, a drachm not equivalent to a fluidrachm, and a minim not commensurate with a grain. It was not until 1836 that the Secretary of the U. S. Treasury was directed by Congress to furnish each State in the Union with a complete set of revised standards, including the *troy-pound* of 5760 grains, from which the Apothecaries', or Troy, weight is derived, the latter term at present being applied only to the system used in weighing precious metals.

For commercial purposes the following Weights and Measures are employed:

Avoirdupois Weights: the Pound divided into 16 Ounces.

Liquid Measures: the "Wine Measure," of which the U. S. Gallon represents a volume of 231 cubic inches; each cubic inch of water at the maximum density (4° C.) being equivalent to 252.892 grains, the weight of a Gallon being therefore 58,418 grains. The Gallon is divided into 8 Pints (octarius), and the Pint is divided into 16 Fluidounces, each containing 8 Fluidrachms, or 480 Minims, the Fluidrachm containing 60 Minims. The signs used to designate these units are—*M*, denoting minim or minims; *℥*, fluidrachm or fluidrachms; and *℥*, fluidounce or fluidounces.

Apothecaries' (Troy) Weight.

20 grains (gr. <i>granum</i>)	= 1 scruple ℥ (<i>scrupulum</i>).
60 grains, or 3 scruples	= 1 drachm ℥ (<i>drachma</i>).
480 grains, or 8 drachms	= 1 ounce ℥ (<i>uncia</i>).
5,760 grains, or 12 ounces	= 1 pound lb (<i>libra</i>).

Apothecaries' (Wine) Measure.

60 minims (℥)	= 1 fluidrachm f℥.
480 minims, or 8 fluidrachms	= 1 fluidounce f℥.
7,680 minims, or 16 fluidounces	= 1 pint O (<i>octarius</i>).
61,440 minims, or 8 pints	= 1 gallon C (<i>congius</i>).

This lack of uniformity in the units and the denominations of the three systems of weights and measures is exemplified in the subjoined table. While the two weight systems have a unit in common, the grain, there is no correlation in the higher denominations, ounces and pounds. The desirability of adopting a fixed standard, applicable in all cases where great accuracy in weights and measures is requisite, has been frequently emphasized by writers on therapeutics. As we have premised, the present difficulty forms a cogent argument in favor of the *metric system*, as wisely adopted in the U. S. Pharmacopœia. A remarkable disparity is shown in the liquid measures, in which there is no unit in common: a minim is not a grain, nor "a pint a pound the world around."

Illustrations.

1 ounce, avoirdupois,	= 437.5 grains.
1 ounce, troy or apothecaries',	= 480 grains.
1 fluidounce of water (the standard of volume)	= 455.7 grains
1 pound, avoirdupois,	= 7000 grains.
1 pound, troy or apothecaries',	= 5760 grains
1 minim of water weighing $\frac{480}{1600}$	= 0.95 grains.
15 grains of water	= 16 minims.

(In the metric system, as seen below, there is but one group of weights, and these bear a definite relation to volume; for one cubic centimeter of water, the standard of volume, weighs exactly one gram.)

THE METRIC SYSTEM

The Metric System of Weights and Measures, destined to supplant all others, originated with Prince de Talleyrand, bishop of

Autun, in 1790. Its almost universal adoption by civilized nations, its legality, though not compulsion, in England and the United States, and its adoption by the U. S. Pharmacopœia of 1890, require that it should be understood alike by the physician and the druggist. Save in the English-speaking world it is the only system used for governmental, statistical, and scientific purposes, and in the arts and manufactures its value has long since been recognized. Its extreme simplicity, its uniformity, and its facility of computation render it far superior to any other system of Weights and Measures, and it is highly probable that in the near future it will prevail in the transactions of every-day life, as it has already acquired international importance, and is in fact referred to as the International System.

The starting-point is the *unit of length*, the meter (*metre*), which is the $\frac{1}{10000000}$ part of the earth's circumference around the poles. From this apparently irrelevant measure of length the *unit of capacity*, or volume, the *liter*, was established, it being the cube of $\frac{1}{10}$ of a meter. With equal simplicity and clearness, from the meter was derived the *unit of weight*, the *gramme*, which is the weight of that quantity of pure water at the maximum density, 4° C. (39.2° F), which will fill the cube of $\frac{1}{1000}$ part of a meter (cubic centimeter).

The Metric is also known as the *Decimal System*, because its multiples and subdivisions are obtained by ten (Lat. *decem*). The prefixes denoting *multiplication* are of Greek derivation, and are usually spelled with a capital letter: Deka 10, Hecto 100, Kilo 1000, Myria 10,000. *Division* of the units is indicated by Latin prefixes, not capitalized: deci $\frac{1}{10}$, centi $\frac{1}{100}$, milli $\frac{1}{1000}$. To distinguish readily one process from the other the word GILD has been aptly suggested as a mnemonic:

G	I	L	D.
Greek	increases,	Latin	decreases.

Contrary to a prevalent opinion, the Metric System is easily mastered. A perfect acquaintance with the metric tables is, naturally, indispensable, and the abbreviations for the different weights and measures should be thoroughly at command. For the rest, the system is simply that of arithmetical decimals, requiring chiefly a correct use of the decimal point. Only a tyro would read .065 *six and five-tenths hundredths* instead of *sixty-five thousandths*; so

Gm. .065 would never be read by one acquainted with decimals *six centigrams and five milligrams*, but *sixty-five milligrams*.

Metric Table of Lengths.

The measures of length employed in prescription writing are the millimeter, centimeter, decimeter, and meter.

10 millimeters	make	1 centimeter.
10 centimeters	"	1 decimeter.
10 decimeters	"	1 Meter.

1 millimeter is written 1 mm., or M .001, equal in inches to	.039370432, approx.	$\frac{1}{25}$.
1 centimeter " 1 cm., " M .01, " "	.39370432,	" $\frac{1}{2}$.
1 decimeter " 1 dm., " M .1, " "	3.9370432,	" 4.
1 Meter " 1 M., " M 1., " "	39.370432,	" 40.

Metric Table of Capacities.

The only measures of capacity employed in prescription writing are the cubic centimeter and the liter. 1000 cubic centimeters (Ccm. or Cc.) make 1 Liter (L.).

Metric Table of Weights.

The weights employed in prescription writing are the milligram, centigram, decigram, gram, and kilogram. The other terms in the following table are but rarely employed abroad and never among English-speaking physicians. It will be seen that one Kilogram represents 1000 Grams.

10 milligrams	make	1 centigram.
10 centigrams	"	1 decigram.
10 decigrams	"	1 Gram.
10 Grams	"	1 Dekagram.
10 Dekagrams	"	1 Hectogram.
10 Hectograms	"	1 Kilogram.
10 Kilograms	"	1 Myriagram.

Abbreviations for the different divisions and multiples of the Gram, with their corresponding equivalents in grains, are as follows :

1 milligram is written 1 mg., or Gm. .001, equal in grains to ($\frac{1}{25}$)	.015432
1 centigram " 1 cg., " Gm. .01 " "	($\frac{1}{2}$) .15432
1 decigram " 1 dg., " Gm. .1, " "	1.5432
1 Gram " 1 Gm., " Gm. 1., " "	15.432

In *writing* prescriptions a physician uses but one system, the metric or the apothecaries'; therefore to *write* prescriptions properly he does not need to know how to convert from one system to the other. He learns one system and adheres to that.

But to *read* and *understand* prescriptions written or spoken in the system other than the one he employs, he must translate them into his own system, and this requires a knowledge of equivalents. Knowing the approximate equivalents, it is then merely a matter of multiplication or division to convert a prescription of one system into a prescription of the other system.

Examples of conversion are:

- 1 milligram = $\frac{1}{1000}$ grain : 5 milligrams = $\frac{5}{1000}$ = $\frac{1}{200}$ grain.
 1 grain = 0.065 Gm., therefore 2 grains = 2×0.065 Gm.
 = 0.13 Gm., and $\frac{1}{1000}$ grain = $\frac{1}{1000} \times 0.065$ Gm.
 = 0.00065 Gm., etc.
 1 ounce = 30.0 Gm. : 4 ounces = 30.0×4 = 120.0 Gm.

The Approximate and Exact Equivalents of Weights, Measures, and Lengths in the Two Systems.

Weights—	Approximate.	Exact.
1 milligram, 0.001 (mg.).	$\frac{1}{160}$ or $\frac{1}{200}$ grain.	0.0154 grain.
1 centigram, 0.01 (cg.).	$\frac{1}{16}$ or $\frac{1}{20}$ grain.	0.1543 grain.
1 decigram, 0.1 (dg.).	$1\frac{1}{16}$ grains.	1.5432 grains.
1 gram, 1.0 (Gm.).	15 grains.	15.4324 grains.
30 grams, 30.0 (Gm.).	1 ounce.	462.9 grains.
31 grams.	1 ounce Troy or 480 grains.	478.4 grains.
1 grain (gr. j.).	0.065 or 0.06 Gm.	0.065 Gm.
10 grains (gr. x.).	0.65 or 0.7 Gm.	0.648 Gm.
15 grains (gr. xv.).	1.0 Gm.	0.972 Gm.
1 scruple (ʒj.).	1.3 Gm.	1.296 Gm.
1 dram (ʒj.).	4 Gm.	3.89 Gm.
1 ounce, troy (ʒij.).	30 or 31 Gm.	31.1 Gm.
1 ounce, avoirdupois (oz.).	28 Gm.	28.35 Gm.
Measures—		
1 cubic centimeter (c.c.).	15 minims.	16.23 minims.
1 liter (1000 c.c.).	34 ounces.	33.8 Cc.
1 minim (℥).	0.06 Cc.	0.061 Cc.
1 fluidram (fʒj.).	4 Cc.	3.696 Cc.
1 fluidounce (fʒij.).	30 Cc.	29.57 Cc.
1 pint (Oj.).	480 Cc.	473.18 Cc.
Lengths—		
1 meter (m.).	40 inches.	39.37 inches.
1 decimeter (dm.).	4 inches.	3.937 inches.
1 centimeter (cm.).	0.4 or $\frac{2}{5}$ inch.	0.3937 inch.
1 inch.	2.5 cm.	2.54 centimeters.

As these equivalents are only approximate, it is well to learn the foregoing "Table of Equivalents" and to avoid multiplying the equivalent of any term by too large a factor, for this likewise multiplies the error. For example: 6 centigrams are approximately 1 grain, but 60 grains are not *360 centigrams*, the error for the equivalent of 1 grain being multiplied sixty times; 60 grains are 1 dram, and the approximate equivalent of 1 dram is 4 grams or *400 centigrams*, a much larger figure.

A. B.—It is perfectly legitimate for a *physician* to use approximate equivalents, for in using equivalents he is merely translating, for his own understanding, prescriptions which have been already written. A *pharmacist* should not need to translate at all, because he should have at hand both the metric and apothecaries' weights and measures, and use whichever the prescription calls for.

PHARMACEUTICAL PREPARATIONS.

PREPARATIONS made by the pharmacist are called *pharmaceutical preparations*. Nearly one-half of the articles of the United States Pharmacopœia are pharmaceutical; formulas being given for their preparation, they are intended to be made in the pharmacy.

The commonly employed medical formularies are:

The Pharmacopœia (*pharmakon*, drug; *poiein*, to make), a book compiled by the government, or, as in the United States, a National Committee on Revision, and published by authority, establishing standards for the identification, purity, strength, and quality, and giving directions for the purification, valuation, preparation, compounding, and preservation of drugs, chemicals, and medicinal preparations. The United States Pharmacopœia is revised decennially, the present (eighth decennial revision) having become official on Sept. 1, 1905.

Official (Lat. *officium*, authority) drugs and preparations are those which are included in the Pharmacopœia—all others are *unofficial*. The term *official* (Lat. *officina*, a shop) was formerly applied to any drugs of recognized standard, but is now little used.

The National Formulary, a work published under the direction of the American Pharmaceutical Association, and designed to standardize the formulae of such much-employed preparations as are not included in the U. S. Pharmacopœia.

Dispensatories—These are compilations and commentaries on the pharmacopœias, and include the medical, physical, and chem-

ical history and nature of the various substances, directions regarding dosage and administration, and observations on their physiological action and therapeutics. They also contain information concerning drugs not accepted by pharmacopœial authority, yet which are of occasional use or interest. The Dispensatory is in effect a private publication and *unofficial*, in this respect differing essentially from a pharmacopœia. There are in the United States various works of this character, the United States and National Dispensatories being commonly in use.

The following are the abbreviations used to indicate which of these is the authority for any given formula, or which formula is intended when more than one go by the same name :

- U. S. P.—United States Pharmacopœia.
- B. P.—British Pharmacopœia.
- P. G.—German Pharmacopœia.
- N. F.—National Formulary.
- U. S. D.—United States Dispensatory.
- N. S. D.—National Standard Dispensatory.

The pharmaceutical preparations may be divided as follows :

- I. Solutions.
- II. Liquid Mixtures—Internal.
- III. Extractive Preparations—Liquid and Solid.
- IV. Mixtures of Solids—Internal.
- V. Mixtures for External Use—Liquids and Solids.

These groups are each divided into a number of Classes, each class having a distinct Latin title by which its members, or individual preparations, are officially designated and alphabetically arranged in the U. S. P. In addition to the Latin and English titles, each class is also known by an English name, besides various synonyms. There are altogether 34 of these Classes official, besides a number unofficial.

*Official
number.*

- I. The Solutions are divided, according to the character of the solvent, into—

<i>Aqueous</i> : Aquæ—Waters	19
Liquores—Liquors (solutions proper).	25
<i>Alcoholic</i> : Spintus—Spirits	20
Elixiria—Elixirs	3
Vina—Wines (by solution)	3

TEXT-BOOK OF MATERIA MEDICA.

	Official number.
<i>Marine</i> : Syrupi—Syrups	29
<i>Cellita</i> —Honey	3
<i>Glycerin</i> : Glycerita—Glycerites	6
<i>Id</i> Mixtures—Internal:	
<i>stura</i> —Mixtures (proper)	4
<i>nulsa</i> —Emulsions	6
<i>e</i> Preparations:	
<i>ous</i> : Mucilagines—Mucilages	4
<i>usa</i> —Infusions	3
<i>ecoccta</i> —Decoctions	0
<i>us</i> : Aceta—Vinegars	2
<i>us</i> : Vina—Wines	7
<i>colic</i> : Tinctura—Tinctures	63
<i>uidextracta</i> —Fluidextracts	85
<i>colic</i> : Extracta—Extracts	28
<i>esina</i> —Resins	3
<i>quid</i> :	
<i>real</i> : Oleoresina—Oleoresins	6
<i>of Solids</i> —Internal:	
<i>lveres</i> —Powders	9
<i>turatio</i> —Trituration	1
<i>les effervescentes</i> —Salts, effervescent	4
<i>nfectiones</i> —Confections	2
<i>ochisci</i> —Troches	9
<i>assa</i> —Masses	2
<i>ulæ</i> —Pills	14
<i>of Solids</i> —External:	
<i>Linimenta</i> —Liniments	8
<i>ecata</i> —Oleates	5
<i>llodia</i> —Collodions	4
<i>Unguenta</i> —Ointments	24
<i>rata</i> —Cerates	6
<i>ppositoria</i> —Suppositories	1
<i>nplastra</i> —Plasters	7
<i>partæ</i> —Papers	1

AQUÆ MEDICATÆ—MEDICATED WATERS.

The Medicated Waters are solutions of volatile substances in Water. They comprise (1) the Aromatic Waters and (2) the Chemical Waters.

The *Aromatic Waters* are made by dissolving the volatile oils of their respective drugs, or distilling the latter with Water; two Waters are saturated solutions of other liquids than volatile oils—viz. Aqua Chloroformi and Aqua Creosoti. The following are official:

Aqua—		Contains Cc. in 100 Cc., or percentage by volume.
Amygdalæ Amaræ	bitter almond oil	0.1
Anisi	anise oil	0.2
Aurantii Florum Fortior	saturated	
Aurantii Florum	of the above	50.
Camphoræ	camphor	0.8
Chloroformi ¹	saturated	
Cinnamomi	cinnamon oil	0.2
Creosoti	creosote	1.
Fœniculi	fennel oil	0.2
Hamamelidis	made by distillation	
Menthæ Piperitæ	peppermint oil	0.2
Menthæ Viridis	spearmint oil	0.2
Rosæ Fortior	saturated	
Rosæ	of the above	50.

The *Chemical Waters* are solutions of gases in Water. The following are official:

Aqua—		Contains gas, percent- age by weight.
Ammoniaæ	NH ₃	10
Ammoniaæ Fortior	NH ₃	28
Hydrogenii Dioxidii (Hydrogen Peroxide) . . .	H ₂ O ₂	3.

LIQUORES—SOLUTIONS.

The Solutions (also termed *Solutio*, -nes, Lat.) are solutions of non-volatile substances in Water.

The official Solutions are all solutions of inorganic salts. They are made either by simple solution (dissolving the particular salt in

¹ Chloroform Water, aside from its medicinal properties, is an efficient preservative agent, and forms a good solvent in place of water for preparing solutions intended to be kept free from micro-organisms, as, for example, those for hypodermic use.

Water) or by chemical solution (reacting upon different substances, and obtaining the newly-formed salt in solution in the Water). The following are official :

The *Arsenic Solutions* ; these are all of the same strength—viz. 1 per cent. ; 3 minims (0.2 Cc.) represent $\frac{1}{30}$ grain (0.002 Gm.) of arsenic, the average dose :

Liquor—	Percentage or Gm. in 100 Cc.
Acidi Arsenosi	acid, arsenous 1.
Arseni et Hydrargyri Iodidi	arsenic iodide 1.
(Donovan's Solution).	mercuric iodide 7.
Potassii Arsenitis	potas. bicarb. 2 ; arsenic trioxide 1.
(Fowler's Solution)	comp. tinct. lavender 3.
Sodii Arsenatis	sodium arsenate 1.

The *Alkaline Salt Solutions*, prepared by saturating an organic acid with an alkaline carbonate or bicarbonate, furnishing an agreeable and refreshing potion (also designated *Saturatio*, *Potio*, Lat.) charged with Carbonic Acid Gas. The *dose* is from 2 to 4 fluid-drachms (8–15 Cc.), except Liq. Magnesiae Citratis :

Liquor—	Gm. in 100 Cc.
Ammonii Acetatis (Spiritus Mindererus)	ammon. carb. 5. acid. acetic, dil. 100.
Magnesii Citratis	magnes. carb. 15. ; acid. citric. 33. potas bicarb. 2.5 ; syrup. acid. citric. 60 Cc. ; aqua ad 350.
Potassii Citratis (Neutral Mixture)	potass. bicarb. 8. acid. citric. 6. ; aqua ad 100.

The *Iron Solutions*, containing *ferric* salts in the following proportions by weight :

Liquor—	Gm in 100, or percentage by weight.
Ferri Chloridi	ferric chloride 29.
Ferri et Ammonii Acetatis	liquor ammon. acet. 50.
(Basham's Mixture).	acid. acetic, dil. 6 ; tr. ferri chlor. 4. elix. arom. 12 ; glycerin 12 ; aqua ad 100.
Ferri Subsulphatis (Monsel's)	ferric subsulphate 13.57 per cent. of metallic Fe
Ferri Tersulphatis	ferric sulphate 36.

The Alkali Solutions:

Liquor—		Percentage by vol. or weight.
Calcis (Lime Water)	calcium hydroxide	0.14
Potassii Hydroxidi	potassium hydroxide	6.
Sodii Hydroxidi	sodium hydroxide	5.6
Sodæ Chlorinatæ (Labarraque's)	chlorine	2.4

The Solutions of Metallic Compounds; used only externally:

Liquor—		Percentage by vol. or weight.
Hydrargyri Nitratis	mercuric nitrate	60.
Plumbi Subacetatis	lead subacetate	25.
Plumbi Subacetatis Dilutus	of above solution	4.
(Lead Water)	distilled water to	100.
Zinci Chloridi	zinc chloride	50.

The Antiseptic Solutions:

Liquor—		Percentage by vol. or weight.
Antisepticus . boric acid 2; benzoic acid 0.1; thymol 0.1; eucalyptol 0.025; oil of peppermint 0.05; oil of gaultheria 0.025; oil of thyme 0.01; alcohol 25.; purified talc 2.		
Chlori Compositus	chlorine	0.4
Cresolis Compositus	cresol	50.
Formaldehydi	formaldehyde	37.

Also,

Liquor Iodi Compositus (Lugol's Solution)	
potass. iodid. 10; iodine	5.
Liquor Sodii Phosphatis Compositus . sodium phosphate	100.

Unofficial Liquors of the National Formulary.

Liquor—	
ACIDI PHOSPHORICI COMPOSITUS (Acid Phosphates).	
ALUMINI ACETATIS (Alumini Acetici, Ph. Ger.).—Contains 8 per cent. of basic Aluminum Acetate.	
ALUMINI ACETICO-TARTRATIS.—Contains about 50 per cent. of dry, so-called Aluminum Acetico-tartrate, which may be obtained by evaporating the solution.	
AURI ET ARSENI BROMIDI.—Ten minims contain $\frac{1}{15}$ grain (0.002 Gm.) of Tribromide of Gold and $\frac{1}{15}$ grain (0.004 Gm.) of Tribromide of Arsenic.	

Liquor—

BISMUTHI.—Each fluidram (4 Cc.) represents 1 grain (0.06 Gm.) Bismuth and Ammonium Citrate.

BROMI (Smith's Solution of Bromine)—Bromine, 20 per cent.; Potassium Bromide, 10 per cent.; Water.

CALCIS SULPHURATÆ (Solution of Oxysulphuret of Calcium; Vlemingx's Solution or Lotion).

CUPRI ALKALINUS (Fehling's Solution).

I. The Copper Solution.

Copper Sulphate, pure grains 505 . . 34.639 Gm.

Distilled Water . . enough to make fluidounces 16 . . 500 Cc.

II. The Alkaline Solution.

Potassium and Sodium Tartrate . . grains 252 . . 173 Gm.

Sodium Hydroxide (U. S. P.) . . . troy ounces 2 . . 60 Gm.

Distilled Water . . enough to make fluidounces 16 . . 500 Cc.

Keep both solutions, separately, in small well-stoppered vials, in a cool and dark place. For use, mix exactly equal volumes of both solutions by pouring the copper solution into the alkaline solution. Ten Cc. of the mixture prepared by metric weight and measure correspond to 0.05 Gm. of glucose. Of the mixture prepared by apothecaries' weight and measure, 310 minims correspond to 1 grain of glucose.

ELECTROPOEICUS (Battery-fluid).

A. For the Carbon and Zinc Battery.—**I.** (For ordinary use)—Potassium Bichromate, in powder, 6 troy ounces (180 Gm.); Sulphuric Acid, commercial, 6 fluidounces (180 Cc.); Water, cold, 48 fluidounces (1400 Cc.).—**II.** (For use with the galvano-cautery).—Sodium Bichromate, in powder, 6½ troy ounces (185 Gm.); Sulphuric Acid, commercial, 14 fluidounces (420 Cc.); Water, cold, 48 fluidounces (1400 Cc.).

Pour the Sulphuric Acid upon the powdered Bichromate and stir the mixture occasionally during one hour. Then slowly add the Water. Sodium Bichromate is more soluble than the Potassium Salt, and also much cheaper. When it cannot be obtained, the Potassium Salt may be substituted for it, weight for weight.

B. For the Leclanché Battery.—Ammonium Chloride, 6 troy ounces (180 Gm.); Water, enough to make 20 fluidounces (600 Cc.); dissolve the Salt in the Water.

FERRI OXYsulphatis (Oxysulphate of Iron).

FERRI PROTOchloridi (Solution of Ferrous Chloride).—Each fluidrachm (4 Cc.) represents about 20 grains (1.3 Gm.) of Protochloride of Iron (ferrous chloride).

HYDRARGYRI ET POTASSII IODIDI (Solution of Iodide of Mercury and Potassium; Channing's Solution).—Red Mercuric Iodide, 72 grains (5.0 Gm.); Potassium Iodide, 56 grains (3.8 Gm.); in Distilled Water, 16 fluidounces (450 Cc.).

Liquor.—

HYPOPHOSPHITUM.—Each fluidrachm (4 Cc.) contains 2 grains (0.12 Gm.) of Calcium Hypophosphite, $1\frac{1}{2}$ grains (0.75 Gm.) of Sodium Hypophosphite, and 1 grain (0.06 Gm.) of Potassium Hypophosphite.

IODI CARBOLATUS (Boulton's Solution; "French Mixture").—Comp. Tincture of Iodine, 110 minims (7 Cc.); Carbolic Acid, 40 grains (3.0 Gm.); Glycerin, $2\frac{1}{2}$ fluidounces (100.0 Cc.); in 16 fluidounces (450 Cc.).

IODI CAUSTICUS (Iodine Caustic; Churchill's Iodine Caustic).—Iodine, 1 troy ounce (31 Gm.); Potassium Iodide, 2 troy ounces (63 Gm.); in Water, 4 fluidounces (120 Cc.).

MAGNESII BROMIDI.—Each fluidounce (30 Cc.) contains about 7 grains (0.5 Gm.) of Magnesium Bromide.

MORPHINÆ CITRATIS.—Each fluidrachm (4 Cc.) contains 2 grains (0.12 Gm.) of Morphine in the form of citrate.

MORPHINÆ HYPODERMICUS (Magendie's Solution of Morphine).¹—16 grains (1 Gm.) Morphine Sulphate to 1 fluidounce (30 Cc.).

PANCREATICUS (Pancreatic Solution).—Each fluidrachm (4 Cc.) represents 1 grain (0.06 Gm.) of Pancreatin, effectually preserved in Glycerin and a little Alcohol.

PEPSINI AROMATICUS.—Each fluidrachm (4 Cc.) represents 1 grain (0.06 Gm.) of Pepsin.

PHOSPHORI (Thompson's Solution of Phosphorus).—Each fluidrachm (4 Cc.) contains about $\frac{1}{4}$ grain (0.0025 Gm.) of Phosphorus, preserved in Absolute Alcohol and Glycerin.

PICIS ALKALINUS (Tar, Alkaline).

POTASSÆ CHLORATÆ (Solution of Chlorinated Potassa; Javelle Water).—An effective and popular disinfectant.

POTASSII ARSENATIS ET BROMIDI (Liquor Arsenii Bromidi; Clemens' Solution).—This solution contains an amount of Arsenic in combination corresponding to about 1 per cent. of Arsenic Trioxide.

The title "Solution of Bromide of Arsenic" (Liquor Arsenii Bromidi), which is often applied to Clemens' Solution or similar preparation, is a misnomer, since bromide of arsenic cannot exist, as such, in presence of water, but is split up into hydrobromic and arsenous acids. The proportions of the ingredients, in the formula above given, have been adjusted as closely as practicable, so as to yield definite compounds—viz. arsenate and bromide of potassium.

¹ Particular care should be taken in prescribing and dispensing this solution, so that it may not be mistaken for the so-called United States Solution of Morphine (Liquor Morphæ Sulphatis, U. S. P. 1870), containing only 1 grain of Sulphate of Morphine in each fluidounce, which is still occasionally used.

Liquor—

SACCHARINI (Solution of Saccharin).—Each fluidram represents 4 grains of Saccharin.

Intended to be used for sweetening liquids and solids when the use of sugar is objectionable, or when a sweet taste is to be imparted to a liquid without increasing its density.

SERIPARUS (Liquid Rennet).

If this liquid is to be used merely for curdling milk, without separating the whey as a distinct layer, it should be added to the milk, previously warmed to a temperature of about 35° C. (95° F.), and the mixture should then be set aside undisturbed until it coagulates. If the whey is to be separated, the Liquid Rennet should be added to the milk while cold, and the mixture heated to about 35° C. (95° F.), but not exceeding 40° C. (104° F.). One part of the liquid should coagulate between 200 and 300 parts of cows' milk.

LIQUOR SODII ARSENATIS, PEARSON.—This Solution contains about $\frac{1}{8}$ per cent. of anhydrous Sodium Arsenate.

This preparation should not be confounded with the *Liquor Sodii Arsenatis* of the U. S. P., which is ten times stronger than the above. Pearson's Solution is official in the French Pharmacopœia, under the title *Soluté d'Arse-nate de Soude* (or *Solution Arsenicale de Pearson*).

SODII BORATIS COMPOSITUS (Dobell's Solution).—Sodium Borate and Sodium Bicarbonate, each 120 grains (8.0 Gm.); Phenol, 24 grains (1.5 Gm.); Glycerin, $\frac{1}{2}$ fluidounce (15 Cc.); in Water, 16 fluidounces (450 Cc.).

SODII CARBOLATIS (Phénol Sodique).—Phenol, 50 per cent.; Sodium Hydroxide, 3 per cent.; in Water.

SODII CITRATIS.—Saturatio (Potio Riveri, Ph. Ger.).—Citric Acid, 150 grains (10.0 Gm.); Sodium Bicarbonate, 190 grains (12.5 Gm.); in Water, 16 fluidounces (450 Cc.).

SODII CITRO-TARTRATIS (Effervescing Saline Water).—Sodium Bicarbonate, Tartaric Acid, Citric Acid, Syrup, and Water, in about the same proportions as in Solution of Magnesium Citrate, for which it is a cheaper substitute.

SODII OLEATIS (Oleate of Sodium).—Intended to be used in the preparation of oleates.

STRYCHNINÆ ACETATIS (Hall's Solution of Strychnine).—Each fluidrachm (4 Cc.) contains $\frac{1}{8}$ grain (0.008 Gm.) Strychnine Acetate.

The Ph. Br. directs a *Liquor Strychninæ Hydrochloratis* (with synonym, *Liquor Strychninæ*) which is much stronger, and should not be confounded with the above preparation. It should never be dispensed unless expressly designated.

Liquor—

ZINCI ET FERRI COMPOSITUS (Deodorant Solution).—A combination of Sulphates of Zinc and Iron, Naphthol, Oil of Thyme, and Hypophosphorous Acid, in Water.

Used as a simple deodorant and antiseptic for common domestic use when it is unnecessary or impracticable to employ more powerful agents.

When a deodorant solution is required for purposes where iron is objectionable—as, for instance, when woven fabrics are to be steeped in it—the following preparation may be employed:

Liquor Zinci et Aluminii Compositus, in which the Iron Sulphate is replaced by Aluminum Sulphate.

ZINGIBERIS (Essence of Ginger).—A 25 per cent. preparation of Ginger for flavoring aqueous mixtures.

SPIRITUS—SPIRITS.

The Spirits are solutions of volatile substances in Alcohol. They comprise (1) the Distilled Spirits; (2) the Aromatic Spirits, or so-called "Essences"; and (3) the Medicinal Spirits.

The *Distilled Spirits* are:

Spiritus Frumenti (Whiskey), containing Alcohol 44–55 per cent. by volume.

Spiritus Vini Gallici (Brandy), containing Alcohol 46–55 per cent. by volume.

The *Aromatic Spirits* are made by dissolving the respective oils or aromatic principles in Alcohol:

Spiritus—	Gt. in 100 Gt., or percentage by vol.	
<i>Amygdalæ Amaræ</i> (water 19) . . . bitter almond oil	1.	
<i>Anisi</i> anise oil	10.	
<i>Aurantii Comp.</i> oil of orange peel	20.	
	oils, anise 0.5; coriander 2; lemon	5.
<i>Camphoræ</i> camphor	10.	
<i>Cinnamomi</i> cinnamon oil	10.	
<i>Gaultheriæ</i> wintergreen oil	5.	
<i>Juniperi</i> juniper oil	5.	
<i>Juniperi Compositus</i> . oil of juniper 0.4; oil of cara-		
	way 0.05; oil of fennel 0.05;	
	alcohol 70; water to make	100.
<i>Lavandulæ</i> lavender oil	5.	
<i>Menthæ Piperitæ</i> peppermint herb 1; oil	10.	
<i>Menthæ Viridis</i> spearmint herb 1; oil	10.	

These are chiefly used for flavoring purposes; some are used

medicinally as aromatic stimulants and carminatives in doses of from 15–30 minims (1–2 Cc.); Spiritus Amygdalæ Amaræ contains Hydrocyanic Acid, and is never used internally except in very small quantities as a flavor.

The *Medicinal Spirits* are made by solutions of the medicinal substance in Alcohol.

The following are official:

Spiritus—		Gr. in 100 Cc., or percentage by vol	
Ætheris	ether (C_2H_5O)	32.5	
Ætheris Comp. (Hoffmann's Anodyne) .	etheral oil	2.5	
	ether	32.5	
Chloroformi	chloroform	6.	
		By weight.	
Ætheris Nitrosi (Sweet Spirit of Nitre) .	ethyl nitrite	4.	
Ammonia	ammonia gas	10.	
Ammonia Aromaticus . .	water 20; ammonia water	9.	
	ammonia carb.	3.4	
	oils, lavender, nutmeg, each 0.1; lemon oil	1.	
Glycerylis Nitratis	nitroglycerin	1.	

The *dose* of these Spirits is from 30 to 60 minims (2 to 4 Cc.; about 75 to 150 "drops"), except the Ammonia Spirit, used only in the preparation of Liniments (externally), and that of Glyceryl Nitrate, of which the dose is 1 minim (0.06 Cc.).

Unofficial Spirits of the National Formulary.

Spiritus—

- ACIDI FORMICI (Spirit of Ants, Ph. Ger.).—A solution of 3 per cent. of Formic Acid in Water and Alcohol.
- OPHTHALMICUS (Alcoholic Eye-wash).—A solution of 10 minims (0.6 Cc.) Oil of Lavender and 30 minims (2 Cc.) Oil of Rosemary, in Alcohol 1 fluidounce (30 Cc.).
- SAPONATUS (Spirit of Soap).
- SINAPIS (Spirit of Mustard, Ph. Ger.).—A solution of 2½ per cent. of Volatile Oil of Mustard in Alcohol.

SYRUPUS—SYRUPS.

Syrups are nearly *saturated* Solutions of Sugar in Water, in which aromatic or medicinal substances are dissolved.

Syrups should be kept in a *cool* place, in cork-stoppered bottles, in order to *preserve* them.

The official Syrup, *Syrupus*, contains 85 grams of sugar in

100 Cc.; with a smaller proportion of Sugar the syrup may undergo fermentation (spoil).

The official Syrups are made by different methods: by solution, or mixing the medicinal substances with the syrup; by dissolving the Sugar in the medicinal solution; by extraction from the drug; and by chemical reaction and solution.

They may be divided into (1) the aromatic or adjuvant syrups, and (2) the medicinal syrups, comprising (a) those made from extractive drugs, and (b) those made from chemicals, either by simple solution or by chemical reaction and solution.

The *Aromatic* or *Adjuvant Syrups* are mostly used to improve the taste of salty, bitter, or otherwise unpleasant mixtures.

The following are official:

Syrupus—		Cc. in 100 Cc. or percentage by vol.
Acaciæ	acacia	10.
Acidi Citrici	tincture of fresh lemon peel	1.
	acid, citric	2.
Amygdalæ	spirit of bitter almond	1.
	orange flower water	10.
Aurantii	tincture of sweet orange peel 5; citric acid	0.5
Aurantii Florum	sugar	85.
	orange flower water to make	100.
Tolutanus	tincture of tolu	5.
Zingiberis	fluidextract of ginger	3.

The *Extractive Syrups* are often made by mixing the Fluid-extract of the respective drugs with Syrup.

Tinctures and Fluidextracts of *resinous* drugs often precipitate when mixed with Syrups and aqueous solutions. In order to furnish clear mixtures it is therefore sometimes necessary to mix the extractive preparation with Water, clarify the mixture by filtration, and dissolve the sugar in the filtered liquid.

The following are official:

Syrupus—		Gm. of Drug in 100 Cc.
Ipecacuanhæ	acetic acid 1; fluidext. ipecac	7.
Krameriæ	fluidext. rhatany	45.
Lactucari	tinct. lactucarium	10.
Piceæ Liquidæ	tar	5.
Pruni Virginianæ	wild cherry	15.
	spirit of cinnamon 0.4, potass. carb.	1.
Rhei	fluidext. rhubarb	10.

		Gm of Drug in 100 Cc.
Syrupus—		
Rhei Aromaticus	tinct. rhubarb, arom.	15.
Rosæ	fluidext. rose	12.5
Rubi	fluidext. rubus	25.
Sarsaparillæ Comp.	fl. ext. sarsaparilla	20.
	fl. ext. glycyrrh., senna, each	1.5
	oils, sassafras, anise, gaultheria, each	0.01
Scillæ	vinegar of squill	45.
Scillæ Comp.	fl. exts. squill, senega, each	8.
(Coxe's Hive Syrup)	antimony and potass. tart.	0.2
Senegæ	fl. ext. senega	20.
Sennæ	oil coriander 0.5; senna	25.

The *Chemical Syrups* are an elegant class of preparations in which the taste of the medicinal agents is greatly modified. They do not keep well unless put up in small bottles completely filled, ready for dispensing. Except the Syrup of Iodide of Iron, which is best preserved in bottles exposed to light, they should be kept in a cool and dark place.

The following are official:

		Percentage, Gm or Cc. in 100.
Syrupus—		
Acidi Hydriodici	acid, hydriodic, by weight	1.
Calcii Lactophosphatis	calcium carbonate 2.5; lactic acid 6; phosphoric acid	3.6
Calcis	lime	6.5
Ferri Iodidi	ferrous iodide, by weight	5.

Ferri, Quininae et Strychninae Phosphatum:

glycerite of the phosphates of iron, quinine,
and strychnine 25.

Hypophosphitum . . . calcium hypophosphite 3 4.5
potassium and sodium hypophosphites, each 1 1.5

tincture of fresh lemon peel 0.5; acid hypo-
phos. dil. 0.2

Hypophosphitum Comp. . calcium hypophos-
phite 3.5; potassium and sodium hypophos-
phites, each 1.75; ferric and manganese
hypophosphites, each 0.225; sodium citrate
0.375; quinine 0.11; strychnine 0.0115;
diluted hypophosphorous acid 1.5.

Grains
in 1 fluid-
dram (4 Cc.).

Percent-
age by
vol.

Unofficial Syrups of the National Formulary.

Unless otherwise stated, the *dose* is 1 to 2 fluidrachms or teaspoonfuls (4-8 Cc.).

Syrupus—

ACTÆE COMPOSITUS (Cimicifuga or Black Cohosh).—Containing $2\frac{1}{2}$ grains (0.15) each of Cimicifuga and Wild Cherry, $1\frac{1}{2}$ grains (0.07) Glycyrrhiza and Senega, and $\frac{1}{2}$ grain (0.04) Ipecac in each fluidrachm (4 Cc.).

ASARI COMPOSITUS (Canada Snake Root).—Each fluidrachm (4 Cc.) represents $3\frac{1}{2}$ grains (0.2) of Asarum.

CALCII CHLORHYDROPHOSPHATIS (Chlorhydrophosphate of Lime).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Calcium Phosphate.

CALCII ET SODII HYPOPHOSPHITUM (Hypophosphite of Lime and Soda).—Each fluidrachm (4 Cc.) contains 2 grains (0.13), each, of Hypophosphites of Calcium and Sodium.

CALCII HYPOPHOSPHITIS (Hypophosphite of Lime).—Each fluidrachm (4 Cc.) contains 2 grains (0.13) of Calcium Hypophosphite.

CALCII IODIDI (Iodide of Calcium).—Each fluidrachm (4 Cc.) contains about 5 grains (0.3) of Calcium Iodide.

CALCII LACTOPHOSPHATIS CUM FERRO (Lactophosphate of Lime with Iron).—Each fluidrachm (4 Cc.) contains $\frac{1}{2}$ grain (0.03) of Lactate of Iron and about $\frac{1}{2}$ grain (0.015) of Calcium Lactate (or about $\frac{1}{2}$ grain (0.02) of so-called Lactophosphate of Calcium).

CHONDRI COMPOSITUS (Irish Moss).—Containing 1 grain (0.06) each of Squill and Senega, $\frac{1}{16}$ grain (0.004) each of Ipecac and Irish Moss, and $1\frac{1}{2}$ minims (0.1) Tincture Opium Camph. to each fluidrachm (4 Cc.).

CINNAMOMI (Cinnamon, Ph. Ger.).—Chiefly used for flavoring.

CODEINÆ.—Containing $\frac{1}{2}$ grain (0.03) Codeine Sulphate in each fluidrachm (4 Cc.). The Syrup of the French Codex is about one-fourth this strength.

COFFEE (Coffee).—Containing 15 grains (1.) of the choicest Coffee (Java and Mocha) in fluidrachm (4 Cc.); an elegant vehicle for Quinine and addition to nauseous mixtures.

ERIODICTYI AROMATICUS (Yerba Santa; Syrupus Corrigens).—Chiefly intended as a vehicle for disguising the taste of Quinine and other bitter substances.

FERRI ARSENATIS.—Each fluidrachm (4 Cc.) contains about $\frac{1}{16}$ grain (0.001) of Arsenate of Iron (ferric).

Syrupus—

FERRI BROMIDI (U. S. P., 1880).—Containing 10 per cent. of Ferrous Bromide.

FERRI CITRO-IODIDI (Tasteless Syrup of Iodide of Iron).—Each fluidrachm (4 Cc.) contains an amount of Iron corresponding to about 3.6 grains (0.25) of Ferric Iodide. The official Syrupus Ferri Iodidi contains about 8 grains (0.5) of Ferrous Iodide (Protiodide of Iron) in each fluidrachm (4 Cc.).

FERRI ET MANGANI IODIDI (Iodide of Iron and Manganese).—Each fluidrachm (4 Cc.) contains 6 grains (0.4) of Iodide of Iron (ferrous) and 3 grains (0.2) of Iodide of Manganese.

FERRI HYPOPHOSPHITIS (Hypophosphite of Iron).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Hypophosphite of Iron (ferric).

FERRI LACTOPHOSPHATIS (Lactophosphate of Iron).—Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Lactate of Iron, or about $1\frac{1}{2}$ grains (0.1) of so-called Lactophosphate of Iron.

FERRI PROTOCHLORIDI (Ferrous Chloride).—Each fluidrachm (4 Cc.) contains about 1 grain (0.06) of Protochloride of Iron.

FERRI SACCHARATI SOLUBILIS (Soluble Saccharated Iron; Saccharated Oxide of Iron, Ph. Ger.).—Each 75 minims (5 Cc.) represents approximately 1 grain (0.06) of Metallic Iron, or 3 grains (0.2) of Oxide of Iron.

GLYCYRRHIZÆ (Liquorice).—Each fluidrachm (4 Cc.) represents 30 grains (2.) of Glycyrrhiza.

HYPOPHOSPHITUM COMPOSITUM.—Each fluidrachm (4 Cc.) contains 2 grains (0.12) of Calcium Hypophosphite, 1 grain (0.06), each, of the Hypophosphites of Potassium and Sodium, $\frac{1}{8}$ grain (0.008), each, of the Hypophosphites of Iron and Manganese, $\frac{1}{8}$ grain (0.004) of Quinine Hydrochlorate, and $1\frac{1}{2}$ minims (0.01) of Tincture of Nux Vomica.

This Syrup should not be confounded with the official Syrupus Hypophosphitum (Syrup of the Hypophosphites: Calcium, Sodium, and Potassium). It is intended to replace a well known proprietary article, for which it has been found by many physicians to be a satisfactory substitute. It is uniform in composition and more stable and elegant than the patent article.

IPECACUANHÆ ET OPII (Syrup of Dover's Powder).—Each fluidrachm (4 Cc.) represents 5 grains (0.3) of Dover's Powder, or $\frac{1}{2}$ grain (0.03), each, of Ipecac and Opium.

Syrupus -

MANNÆ (Syrup of Manna, Ph. Ger.).

MORPHINÆ COMPOSITUS.—A preparation sometimes dispensed as Jackson's Pectoral Syrup, but, as it differs in essential particulars, the N. F. recommends that this preparation be dispensed only when expressly designated under this title. Each fluidrachm (4 Cc.) contains $\frac{1}{2}$ grain (0.008) Ipecac, 5 grains (0.3) Senega, 1 grain (0.06) Rhubarb, and $\frac{1}{12}$ grain (0.002) Morphine, with Oil of Sassafras.

MORPHINÆ SULPHATIS (Syrup of Morphine).—Each fluidrachm (4 Cc.) contains $\frac{1}{2}$ grain (0.008) of Sulphate of Morphine.

PAPAVERIS (Poppy, Ph. Br.; *Diacodii*, Ph. Ger.).—Similar to the preceding, but considerably weaker.

PECTORALIS (Jackson's Pectoral Syrup).—Each fluidrachm (4 Cc.) contains $\frac{1}{12}$ grain (0.002), each, of Morphine and Oil of Sassafras.

PHOSPHATUM COMPOSITUS (Chemical Food).—Each fluidrachm (4 Cc.) contains about 2 grains (0.12) of Phosphate of Calcium, 1 grain (0.06), each, of the Phosphates of Iron and Ammonium, and smaller quantities of the Phosphates of Potassium and Sodium.

PINI STROBI COMPOSITUS (White Pine Compound).—A combination of White Pine, Wild Cherry, Spikenard, Sanguinaria, Chloroform, and Morphine, $\frac{1}{12}$ grain (0.002) in a fluidrachm.

RHAMNI CATHARTICÆ (Buckthorn Berries; *Syrupus Spinæ Cervinæ*, Ph. Ger.).

RUBI AROMATICUS (Blackberry, Aromatic).—A combination of Rubus, Cinnamon, Nutmeg, Cloves, and Allspice.

SANGUINARIÆ (Bloodroot).—Each fluidrachm (4 Cc.) represents 13 grains (0.8) of Sanguinaria.

SENNÆ AROMATICUS (Senna, Aromatic).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) of Senna, 3 grains (0.2) of Jalap, and 1 grain (0.06) of Rhubarb, with aromatics.

SENNÆ COMPOSITUS (Senna, Compound).—Each fluidrachm (4 Cc.) represents 8 grains (0.5) of Senna, 2 grains (0.12), each, of Rhubarb and Frangula.

SODII HYPOPHOSPHITIS.—Each fluidrachm (4 Cc.) contains 2 grains (0.12) of Sodium Hypophosphite.

STILLINGIÆ COMPOSITUS.—Each fluidrachm (4 Cc.) represents 15 minims (1 Cc.) of Compound Fluid Extract of Stillingia.

Syrupus—

OXYMEL SCILLÆ (Oxymel of Squill, Ph. Br.).—A preparation of Honey containing about 5 grains (.32 Gm.) of Squill in each fluidrachm (4 Cc.).

ELIXIRIA—ELIXIRS.

Elixirs are a class of elegant preparations similar to wines or cordials, composed of Water, Sugar, Alcohol, and Aromatics.

The medicinal substances are usually in such proportion that an ordinary dose may be contained in one or two teaspoonfuls (4 to 8 Cc.) of the elixir. The official Elixirs are:

Elixir Adjuvans:

fluidextract of glycyrrhiza 12; aromatic elixir 88.

Elixir Aromaticum:

compound spirit of orange 1.2; syrup 37.5; alcohol 25.

Elixir Ferri, Quininæ et Strychninæ Phosphatum:

soluble ferric phosphate 1.75; quinine 0.875; strychnine 0.0275; phosphoric acid 0.2 [each fluidram contains 1 grain (0.06 Gm.) of ferric phosphate, and $\frac{1}{2}$ grain (0.03 Gm.) quinine, and $\frac{1}{8}$ grain (0.001 Gm.) strychnine in the form of phosphate].

Elixirs of the National Formulary.

The value of pleasant vehicles to mask or modify the taste of bitter and nauseous drugs is recognized by every prescriber. The following Elixirs of the National Formulary have been carefully selected, and embrace the most effective combinations of adjuvants and aromatics for disguising the different drugs for which they are recommended:

Elixir—

ANISI; a combination of Anethol, Fennel, and Bitter Almond.

CURASSAO (Curaçao Cordial); a combination of Curaçao, Ornis, and a little Citric Acid.

Adjuvant Elixirs.—The following are intended as vehicles for Quinine and similar bitter substances, and as adjuvants for Tinctures and Fluid Extracts of bitter and resinous drugs, such as Cinchona, Cascara Sagrada, etc. They all contain Glycyrrhiza, which, in the form directed in the N. F. (Russian Licorice Root, peeled), is most effective in masking the bitter taste of Quinine, when it is directed to be simply suspended in the mixture without the use of acid for effecting solution. Acids precipitate the glycyrrhizin and destroy its power of masking the bitter taste:

Elixir—

ADJUVANS; a combination of Orange, Wild Cherry, Glycyrrhiza, Coriander, and Caraway.

Except for the exhibition of Quinine this is the most effective of the adjuvant Elixirs.

ERIODICTYI AROMATICUM (Arom. Elixir Yerba Santa; Elixir Corrigens).—A solution of Yerba Santa in Comp. Elixir of Taraxacum, intended as a vehicle for Quinine and other bitter remedies.

GLYCYRRHIZÆ (Elixir of Licorice); a solution of Licorice in Aromatic Elixir, the most effective vehicle for Quinine.

GLYCYRRHIZÆ AROMATICUM; Elixir of Licorice, with the addition of strong aromatics.

TARAXACI COMPOSITUM; an improved form of this well-known compound, useful as a mild adjuvant.

Medicinal Elixirs.—These comprise the Elixirs mostly in use; also, a number of preparations in which the prescriber will find satisfactory substitutes, designated by scientific titles and of definite strength and uniform composition, intended to replace various nostrums.

Elixir—

Active Drug in
℥ Fluidrachm. ʒ Cc.
grams. Gm.

ACIDI SALICYLICI	5	0.3
AMMONII BROMIDI	5	0.3
AMMONII VALERIANATIS	2	0.12

The odor and taste of the salt being well covered by the addition of vanilla and a little chloroform.

AMMONII VALERIANATIS ET QUININÆ.—The above, with Quinine Hydrochlorate ʒ 0.015

APII GRAVEOLENTIS (Celery Compound).—Containing Celery, Coca, Kola, and Viburnum, each 4 0.25

BISMUTHI.—Bismuth and Ammonium Citrate 2 0.12

BUCHU 7½ 0.5

BUCHU COMPOSITUM.—Buchu, Cubeb, Juniper, and Uva Ursi, combined 15 1.

BUCHU ET POTASSII ACETATIS.—Elixir Buchu, with Potassium Acetate 5 0.3

CAFFEINÆ.—Caffeine (in solution in Hydrobromic Acid) 1 0.06

CALCII BROMIDI 5 0.3

	Active Drug in	
	<i>℥ fluidrachm</i> Grains	<i>℥ Cc.</i> Gm.
Elixir—		
CALCII HYPOPHOSPHITIS	2	0.12
CALCII LACTOPHOSPHATIS.—Calcium Lactate (in Phosphoric Acid)	1	0.06
CATHARTICUM COMPOSITUM.—Each fluidrachm (4 Cc.) contains Senna $7\frac{1}{2}$ grains (0.5); Podo- phyllum 4 grains (0.25); Leptandra and Jalap, each 3 grains (0.2); Rochelle Salts $7\frac{1}{2}$ grains (0.5); and Sodium Bicarbonate 1 grain (0.06). The mixture should be shaken.		
CHLOROFORMI COMPOSITUM.—A mixture of equal parts of Chloroform, Tincture of Opium, Spirit of Camphor, Aromatic Spirit of Ammonia, and Alcohol, flavored with Cin- namon. The old title, "Chloroform Pare- goric," is recommended to be abandoned for the above. Each fluidrachm (4 Cc.) contains 1 grain (0.06) of Opium and 11 minims (0.7) of Chloroform.		
CINCHONÆ (Elixir Calisaya).—This preparation is from the best Calisaya Bark, representing about 2 grains (0.12) in each fluidrachm (4 Cc.). It is preferable to preparations made from Quinine and the cheaper alkaloids in being a more agreeable and effective anti- periodic tonic.		
CINCHONÆ ET FERRI (Calisaya and Iron; Fer- rated Elixir of Calisaya).—Phosphate of Iron .	2	0.12
CINCHONÆ ET HYPOPHOSPHITUM.—Calcium and Sodium Hypophosphites, each	1	0.06
CINCHONÆ, FERRI, BISMUTHI ET STRYCHNINÆ. —Phosphate of Iron	2	0.12
Bismuth and Ammonium Citrate	1	0.06
Strychnine Sulphate	$\frac{1}{100}$	0.0007
CINCHONÆ, FERRI ET BISMUTHI.—Phosphate of Iron	2	0.12
Bismuth and Ammonium Citrate	1	0.06
CINCHONÆ, FERRI ET CALCII LACTOPHOSPHATIS. —Phosphate of Iron	$1\frac{1}{2}$	0.1
Calcium Lactophosphate about	1	0.06

Elixir—

		<i>Active Drug in</i>	
		<i>1 Fluidrachm. 4 Cc.</i>	
		<i>Grains.</i>	<i>Gm.</i>
CINCHONÆ, FERRI ET PEPSINI.—Phosphate of			
Iron	1½	0.1	
Pepsin	1	0.06	
CINCHONÆ, FERRI ET STRYCHNINÆ.—Phosphate			
of Iron	2	0.12	
Sulphate of Strychnine	100	0.0007	
CINCHONÆ, PEPSINI ET STRYCHNINÆ.—Contain-			
ing smaller quantities of the Cinchona Alka-			
loids, Pepsin 1 grain (0.06), and Sulphate			
of Strychnine	100	0.0007	
COCÆ (Coca).—Leaves, Erythroxylon Coca . .	7½	0.5	
COCÆ ET GUARANÆ.—Coca and Guarana, of each	7½	0.5	
CORYDALIS COMPOSITUM.—Containing of Cory-			
dalis, Stillingia, Iris, and Xanthoxylum,			
combined	15	1.	
Potassium Iodide	3	0.2	
DIGESTIVUM COMPOSITUM.—Containing about 5			
grains (0.3) of Pulvis Digestivus in each			
fluidrachm (4 Cc.).			
EUCALYPTI.—Eucalyptus Globulus	7½	0.5	
EUONYMI (Wahoo).—Euonymus Atropurpureus	10	0.6	
FERRI HYPOPHOSPHITIS.—Hypophosphite of			
Iron (ferne)	1	00.6	
FERRI LACTATIS	1	0.06	
FERRI PHOSPHATIS.—Phosphate of Iron (U.S P.)	2	0.12	
FERRI PHOSPHATIS, CINCHONIDINÆ ET STRYCH-			
NINÆ.—Phosphate of Iron			
Cinchonidine	½	0.03	
Sulphate of Strychnine	100	0.0007	
FERRI PHOSPHATIS, QUININÆ ET STRYCHNINÆ.			
—Phosphate of Iron, 1 grain (0.06), Qui-			
nine	½	0.03	
Sulphate of Strychnine	100	0.0007	
FERRI PYROPHOSPHATIS	2	0.12	
FERRI, QUININÆ ET STRYCHNINÆ.—Ferric Chlo-			
ride, 1 grain (0.06); Quinine Hydrochlorate			
Sulphate of Strychnine	100	0.0007	
FRANGULÆ (Buckthorn).—Rhamnus Frangula .	15	1.	

Elixir—	Active Drug in	
	1 Fluidrachm. & Co. Grains.	Gm.
GENTIANÆ	2	0.12
GENTIANÆ CUM TINCTURA FERRI CHLORIDI.— Tincture Citro-chloride of Iron	5	0.3
GENTIANÆ ET FERRI PHOSPHATIS (ferrophosphated).—Phosphate of Iron	1	0.06
GRINDELIA.—Grindelia Robusta	4	0.25
GUARANÆ.—Paullinia Cupana	12	0.75
HUMULI	7½	0.5
HYPOPHOSPHITUM.—Calcium Hypophosphite	3	0.2
Sodium and Potassium Hypophosphites, each	1	0.06
HYPOPHOSPHITUM CUM FERRO.—Calcium and Sodium Hypophosphite, each	1	0.06
Potassium and Iron Hypophosphites, each	½	0.03
LITHII BROMIDI	5	0.3
LITHII CITRATIS	5	0.3
LITHII SALICYLATIS	5	0.3
MALTI ET FERRI.—Phosphate of Iron	1	0.06
Malt Extract	15	1.
PARALDEHYDI.—Paraldehyde	15	1.
PEPSINI.—Pepsin	1	0.06
PEPSINI, BISMUTHI ET STRYCHNINÆ.—Elixir Pepsin and Bismuth, and Strychnine	100	0.0007
PEPSINI ET BISMUTHI.—Pepsin	1	0.06
Bismuth and Ammonium Citrate	2	0.12
PEPSINI ET FERRI.—Elixir of Pepsin and Tincture Citro-chloride of Iron	5.	0.3
PHOSPHORI ET NUCIS VOMICÆ.—Elixir Phosphorus, with Tincture Nux Vomica	2	0.12
PICIS COMPOSITUM.—A combination of Prunus Virginiana, Tolu, Methylic Alcohol, and Sulphate of Morphine	80	0.0015
PILOCARPI (Jaborandi).—Pilocarpus Selloanus	4	0.25
POTASSII ACETATIS	5	0.3
POTASSII ACETATIS ET JUNIPERI.—Elixir Potass. Acet. with Juniper	7½	0.5
POTASSII BROMIDI.—Potassium Bromide, effectually masked in Adjuvant Elixir	10	0.6
An Elixir half this strength has also been used.		

Elixirs—

Active Drug in
1 Fluidrachm. 4 Cc.
Grains. Gm.

QUININÆ COMPOSITUM (Red).— Sulphates of Quinine, $\frac{1}{8}$ grain (0.008), Cinchonidine and Cinchonine, each			$\frac{1}{18}$	0.004
Chiefly intended as a substitute for Elixir Cinchona when the administration of other constituents of the bark may be deemed objectionable.				
QUININÆ ET PHOSPHATUM COMPOSITUM.— Quinine Sulphate			$\frac{1}{4}$	0.015
Phosphate of Iron			1	0.06
Calcium Lactophosphate			$\frac{3}{4}$	0.05
QUININÆ VALERIANATIS ET STRYCHNINÆ.— Valerianate of Quinine			1	0.06
Sulphate of Strychnine			$\frac{1}{100}$	0.0007
RHAMNI PURSHIANÆ (Cascara Sagrada).— Rhamnus Purshiana, its bitterness effectually masked with Elixirs of Glycyrrhiza and Taraxacum Compound			15	1.
RHAMNI PURSHIANÆ COMPOSITUM (Laxative Elixir; Elixir Purgans).— Cascara Sagrada .			$7\frac{1}{2}$	0.5
Senna and Juglans, each			5	0.3
Associated with aromatics and correctives; a most effective laxative in doses of from 1 to 2 fluidrachms (4–8 Cc.).				
RHEI.— Sweet Tincture of Rhubarb, representing Rhubarb			$2\frac{1}{2}$	0.15
RHEI ET MAGNESIÆ ACETATIS.— Magnesium Acetate, 4 grains (0.25); Rhubarb			$7\frac{1}{2}$	0.5
RUBI COMPOSITUM (Blackberry Compound).— Blackberry Root, Galls, and Cinnamon (Saigon), in equal proportions, combined			10	0.6
with smaller quantities of Cloves, Mace, and Ginger, in Blackberry Juice and Syrup.				
SODII BROMIDI.— Sodium Bromide, in Adjuvant Elixir			10	0.6
SODII HYPOPHOSPHITUM			2	0.12
SODII SALICYLATIS (to be freshly prepared when required for use)			5	0.3

	<i>Active Drug in</i>	
	<i>1 Fluidrachm—4 Cc.</i>	<i>Grains. Gm.</i>
Elizir—		
STILLINGIÆ COMPOSITUM.—Compound Fluid		
Extract of Stillingia, N. F.	15	1.
STRYCHNINÆ VALERIANATIS	$\frac{1}{100}$	0.0007
TURNERÆ (Damiana).—Turnera Aphrodisiaca	10	0.6
VIBURNI OPULI COMPOSITUM.—Viburnum Opu-		
lus, Aletris Farinosa, each	5	0.3
Trillium (Beth Root)	10	0.6
VIBURNI PRUNIFOLII (Black Haw)	$7\frac{1}{2}$	0.5
ZINCI VALERIANATIS.—Zinc Valerianate	1	0.06

CORDIALE RUBI FRUCTUS (Blackberry Cordial).—An aromatic Syrup of Blackberry Juice, used as a mild astringent in bowel complaints.

SUCCUS LIMONIS CUM PEPsINO (Lime Juice and Pepsin).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Pepsin.

GLYCERITA—GLYCERITES.

The Glycerites, or "Glyceroles," are solutions of substances in Glycerin.

They are made either by direct solution, by heat, or by extraction of a drug, as in Hydrastis; one is made by chemical reaction—*i. e.* Boroglycerin.

Glyceritum—	<i>Percentage by weight.</i>
Acidi Tannici acid, tannic	20.
Amyli water 10; starch	10.
Boroglycerini (boric acid 31. or) boroglyceride	50.
Glyceritum Ferri, Quininæ et Strychninæ Phosphatum	
soluble ferric phosphate 8, quinine 10 4, strychnine 0.08,	
phosphoric acid 20 [$\frac{1}{2}$ Cc. contains 0.104 Gm. ($1\frac{3}{8}$	
gr) quinine, and 0.0008 Gm. ($\frac{1}{80}$ gr.) strychnine].	
Hydrastis representing hydrastis	100.
Phenolis liquefied phenol	20.

The Glycerite of Starch is used chiefly as an excipient for Pill-masses.

Unofficial Glycerites of the National Formulary.

Glyceritum—	
PEPSINI (Glycerole of Pepsin).—Each 4 Cc. (fluidrachm) represents 0.3 (5 grains) of Pepsin.	
PICIS LIQUIDÆ (Tar).—Containing about 0.3 (5 grains) of Tar.	
TRAGACANTHÆ.—Containing about 12 per cent. of tragacanth.	

MUCILAGINES—MUCILAGES.

The Mucilages are prepared by extracting a mucilaginous drug with Water or dissolving a Gum in Water.

The following four are official :

		<i>Gm. in 100 Gr. or percentage.</i>
Mucilago—		
Acaciæ	lime water 33; acacia	34.
Sassafras Medullæ	sassafras pith	2.
Tragacanthæ	glycerin 18; tragacanth	6.
Ulmī	slippery-elm bark	6.

The Mucilages are chiefly employed as vehicles in Mixtures to aid in suspending insoluble substances ; as excipients in Pills and Troches ; and as emulsifying agents. They are sometimes used for their demulcent effect.

THE LIQUID MIXTURES—INTERNAL.

MISTURÆ—MIXTURES.

The official Mixtures are liquid preparations, for internal use, of medicinal substances suspended in Water containing *sugar, gum, or glycerin*. They require to be shaken up before using. They should be prepared extemporaneously. The term Mixture is also applied to any combination of substances that cannot be otherwise classified.

There are four official mixtures :

		<i>Gms. in 100 Gr.</i>
Mistura—		
Cretæ (Chalk Mixture)	comp. chalk powder	20.
	cinnamon water 40; water, to	100.
Fern Comp. (Griffith's Mixt.)	myrrh, sugar, each	1.8
	potass. carb.	0.8
	triturate with gradual addition of rose water	70.
	ferrous sulphate, 0.6; spir. lavend., 6; rose water, to	100.
Glycyrrhizæ Comp.	pure extract glycyrrhiza	3.0
(Brown Mixture)	Spirit nitrous ether	3.
	wine antimony	6.
	tinct. opium. camph.	12.
	syrup 5; acacia 3; water, to	100.
Rhei et Sodæ	sodium bicarbonate	3.5
	fl. exts. ipecac 0.3, rhubarb	1.5
	spirit peppermint 3.5; glycerin 35.; water, to	100.

A TEXT-BOOK OF MATERIA MEDICA.

Unofficial Mixtures of the National Formulary.

Mistura—

ACACIÆ—(Mistura Gummosa, Ph. Ger.)—Acacia, pulv., Sugar, in Water.

Should be freshly made when wanted for use.

ADSTRINGENS ET ESCHAROTICA (Villate's Solution).—Solution of Lead Subacet. $1\frac{1}{2}$ fluidounces (45.); Sulphates of Copper, Zinc, each, 1 troy ounce (30.); Acetic Acid 13 fluidounces (360 Cc.).

AMMONII CHLORIDI (Mistura Solvens Simplex).—Ammonium Chloride, Purif. Ext. Glycyrrhiza, each 180 grains (12.), in Water 16 fluidounces (450 Cc.).

Mistura (or *Mixture*) *Solvens Stibiata* is prepared by dissolving 0.3 Antimony and Potassium Tartrate in 1000 Cc. of Mistura Ammonii Chloridi.

CAMPHORÆ ACIDA (Mistura Antidysenterica; Hope's Mixture).—Nitric Acid 120 mins. (8 Cc.); Tinct. Opium 80 mins. (5 Cc.); in Camphor Water 16 fluidounces (450 Cc.).

CAMPHORÆ AROMATICA (Parrish's Camphor Mixture).—Tinct. Lavender Comp. 4 fluidounces (120 Cc.); Sugar 240 grains (15.); in Camphor Water 16 fluidounces (450 Cc.).

CARMINATIVA (Dalby's Carminative).—Magnes. Carb. 1 troy ounce (30.); Potass. Carb. 20 grains (1.3); Tinct. Opium 180 mins. (12 Cc.); Oils of Caraway, Fennel, Peppermint, each, 4 drops (0.1); Syrup $2\frac{1}{2}$ fluidounces (75 Cc.); in 16 fluidounces (450 Cc.). Each fluidounce (30 Cc.) represents about 1 grain of Opium (0.06).

CHLORALIS ET POTASSII BROMIDI COMPOSITA (Mixture of Chloral and Bromide).—Each fluidrachm (4 Cc.) contains 15 grains (1.), each, of Chloral and Potassium Bromide, and $\frac{1}{2}$ grain (0.008), each, of Exts. Indian Cannabis and Hyoscyamus.

CHLOROPFORMI ET CANNABIS INDICÆ COMPOSITA (*Chloroform Anodyne*).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ minims (0.5 Cc.), each, of Chloroform and Tinct. Indian Cannabis; $3\frac{1}{2}$ minims (0.25 Cc.) Tinct. Capsicum; and about $\frac{1}{4}$ grain (0.01) of Morphine Sulph.

CONTRA DIARRHŒAM (*Cholera Mixture*).—Tinctures of Opium, Capsicum, Rhubarb, and Spirits of Camphor and Peppermint, each, equal volumes.

The above formula appears to be that in most general use, also known under the name of "Sun Mixture."

Mixture—

Of other similar preparations in more or less general use, the following may be mentioned here:

2. *Loomis' Diarrhea Mixture*.—Tincture Opium, $\frac{1}{2}$ fluidounce (15 Cc.); Tincture Rhubarb, $\frac{1}{2}$ fluidounce (15 Cc.); Tincture Catechu Comp., 1 fluidounce (30 Cc.); Oil of Sassafras, 20 minims (1.3 Cc.); Tincture Lavender Comp., to make 4 fluidounces (120 Cc.).

3. *Squibb's Diarrhea Mixture*.—Tincture Opium, 1 fluidounce (30 Cc.); Tincture Capsicum, 1 fluidounce (30 Cc.); Spirit of Camphor, 1 fluidounce (30 Cc.); Purif. Chloroform, 180 minims (12 Cc.); Alcohol, enough to make 5 fluidounces (150 Cc.).

4. *Thielemann's Mixture* (Mixt. Thielemanni, Ph. Succ.).—Wine Opium, 1 fluidounce (30 Cc.); Tinct. Valerian, $1\frac{1}{2}$ fluidounces (45 Cc.); Ether, $\frac{1}{2}$ fluidounce (15 Cc.); Oil Peppermint, 60 minims (4 Cc.); Fl. Ex. Ipecac, 15 minims (1 Cc.); Alcohol, to make 4 fluidounces (120 Cc.).

5. *Velpeau's Diarrhea Mixture*.—Tincture Opium, Tincture Catechu Comp., Spirit Camphor, of each, equal volumes.

COPAIBA COMPOSITA—

1. *Lafayette Mixture*.—Copaiba, 2 fluidounces (60 Cc.); Tinct. Lavender Comp., 2 fluidounces (60 Cc.); Solution Potassa, $\frac{1}{2}$ fluidounce (15 Cc.); Spirit Nitr. Ether, 2 fluidounces (60 Cc.); Syrup, 5 fluidounces (150 Cc.); Mucilage Dextrin, to make 16 fluidounces (450 Cc.). This mixture should be well agitated when used. Each fluidrachm contains $7\frac{1}{2}$ minims of Copaiba.

2. *Chapman's Mixture*.—Copaiba, 4 fluidounces (125 Cc.); Tinct. Lav. Comp., 240 minims (15.5 Cc.); Tincture Opium, 240 minims (15.5 Cc.); Spirit Nitro. Ether, 4 fluidounces (125 Cc.); Mucilage Acacia, $1\frac{1}{2}$ fluidounces (45 Cc.); Water, to make 16 fluidounces (450 Cc.).

EXPECTORANS, STOKES (Stokes' Expectorant).—Ammonium Carb., 120 grains (8.); Fl. Ext. Senega, $\frac{1}{2}$ fluidounce (15 Cc.); Fl. Ext. Squill, $\frac{1}{2}$ fluidounce (15 Cc.); Tinct. Opium, Camph., $2\frac{1}{2}$ fluidounces (80 Cc.); Water, $1\frac{1}{2}$ fluidounces (45 Cc.); Syrup Tolu, to make 16 fluidounces (450 Cc.).

GUAIACI (Guaiac Mixture, Ph. Br.).—Resin Guaiac, Sugar, each, 190 grains (12.5); Acacia Powder, 100 grains (7.); Cinnamon Water, 16 fluidounces (450 Cc.). To be well agitated when used.

Mistura—

MAGNESIÆ ET ASAFÆTIDÆ (U. S. P. 1880).—Dewees' Carminative.—Magnesium Carbonate, 90 grains (6.0); Tinct. Asafoetida, 2 fluidrachms (8 Cc.); Tinct. Opium, 20 minims (1.2 Cc.); Sugar, 180 grains (12.0); Water, to make 4 fluidounces (120 Cc.).

OLEI BALSAMICA (Balsamum Vitæ Hoffmanni, Ph. Ger.).—A solution of Oils of Lavender, Thyme, Lemon, Mace, Orange-flowers, Cloves, Cinnamon, and Balsam Peru in Alcohol.

OLEI PICIS (Tar Mixture).—A mixture of Oil of Tar, $\frac{1}{2}$ fluidounce (15 Cc.); Chloroform, 75 minims (5 Cc.); Oil of Peppermint, 20 minims (1.3 Cc.), in Elixir, to make 16 fluidounces (450 Cc.).

RHEI COMPOSITA (Squibb's Rhubarb Mixture).—Fl. Ext. Rhubarb, 120 minims (6. Cc.); Fl. Ext. Ipecac, 16 minims (1. Cc.); Sodium Bicarb., 330 grains (11.); Glycerin, 6 fluidounces (240.), in Peppermint Water, 16 fluidounces (450 Cc.).

SASSAFRAS ET OPII (Mist. Opii Alkalina; Godfrey's Cordial).—A mixture of Oil of Sassafras, Tincture of Opium, and Potass. Carb. in Molasses, Alcohol, and Water. Each fluidrachm (4 Cc.) contains 2 minims (0.12) Tinct. Opium, corresponding to $\frac{1}{2}$ grain (0.01) Opium.

SODÆ ET MENTHÆ (Soda Mint).—Sodium Bicarb., 320 grains (20.); Spirit Ammonia Arom., 4 Cc. (60 minims); Spearmint Water, 16 fluidounces (450 Cc.).

SPLENETICA (Spleen Mixture; Gadberry's Mixture).—Iron Sulphate, Quinine Sulphate, Nitric Acid, each, 100 grains (7.); Potassium Nitrate, 300 grains (20.), in Water, 16 fluidounces (450 Cc.).

SULPHURICA ACIDA (Haller's Acid Elixir, Ph. Ger.).—Sulphuric Acid, 1 part; Alcohol, to make 4 parts, by weight.

EMULSA—EMULSIONS.

Emulsions are liquid preparations consisting of *oily, fatty, resinous*, or otherwise *insoluble* substances suspended in watery liquids by the intervention of gum, mucilage, or other viscid matter. The object of emulsifying a substance is to render it easily miscible with water.

For the internal administration of Oils it is often necessary to exhibit them in a palatable form, so that they may be borne by the stomach and their assimilation favored. This is usually effected by

suspending the oil in a watery liquid or mixture by means of an *emulsifying agent*, such as acacia, etc.

Many natural substances are intimate mixtures of oils or fats with water, in the form of an emulsion. Of animal products, Milk is a most perfect emulsion; so is Egg-yolk. From the Milk-juice of some plants the water evaporates and the dried milk-juice collects in portions of the plant or exudes from them when wounded; in this way the gum-resins of *asafœtida*, etc., are produced. From these substances Emulsions may be obtained by restoring the water lost by evaporation—that is, by rubbing them with water in a mortar. In this way the so-called *natural Emulsions* are made.

Artificial Emulsions.

These are made by mixing the Oil with a certain proportion of the emulsifying agent, adding Water, and triturating the mixture in a mortar or agitating it in a flask.

There are various methods, but these are general rules:

The emulsification of the oil should be *complete* before the mixture is made up to the required measure.

When alcoholic liquids are to be added, they should first be *diluted* as much as possible.

Salts should be *dissolved* before being added.

No heat should be employed, as the oil *separates* when an emulsion is heated.

Emulsions should be *freshly* prepared and be preserved in a *cold* place.

The most common emulsifying agent is Powdered Gum Acacia (*Acacia pulv.*) The Oil is thoroughly mixed by trituration in a mortar with *one-fourth* its weight of powdered Acacia. To this *one and a half times as much* water as of gum is added *at once*, and the mixture is rapidly triturated with a rotary motion of the pestle until it becomes stiff and assumes a milk-white color. This so-called "*mother-emulsion*" may now be diluted to the required measure, and other substances, flavors, etc. be added.

Powdered Tragacanth may be used in the same way or in the form of mucilage, but it does not produce so permanent emulsions as does gum acacia.

The Mucilages of Acacia and of Irish Moss are not so satisfactory as powdered gum: while they produce a good emulsion, the division of the oil-globules is not so thorough as in the preceding: emulsification being incomplete, the mixture more rapidly separates into a heavier, watery liquid and a lighter, thick, gelatinous emulsion, which requires thorough mixing before use.

Extract of malt is an excellent emulsifying agent when its use is admissible. The Oil should be added to the Malt Extract contained in a capacious mortar, and incorporated in small quantities at a time. A good article will emulsify an equal volume of cod-liver oil.

Condensed Milk and Egg-yolk produce the most perfect emulsions, and also the most palatable, but they rapidly ferment and spoil.

Glycerin and sugar added to emulsions for the purpose of preservation and palatability induce separation, and their use is not advisable.

Emulsification "by intervention" is the best and only reliable method to be employed with Ethereal Oils and all substances of themselves not emulsifiable. The process is illustrated in the official Chloroform Emulsion.

Oil of Turpentine, for example, is emulsified by dissolving the Turpentine Oil in a bland fixed oil (Almond Oil), incorporating an equal weight of powdered Acacia, adding Water, and proceeding as with an ordinary emulsion.

Pancreatin emulsionizes fats in preparing them for digestion, but it does not produce a permanent emulsion when used artificially. While, therefore, not a reliable emulsifying agent, it aids the assimilation of oils, and its addition to emulsions is sometimes therapeutically desirable. As it is more active in alkaline media, the Emulsion should be prepared with a little Sodium Bicarbonate.

The addition of Alkalies to emulsions should be avoided. Soaps are not Emulsions, nor is the use of Soap-bark to be recommended.

The official emulsions are :

Emulsion—	Gm in 100 Cr., or percentage by vol.
Amygdalæ	sweet almond 6.
	sugar 3; acacia 1.
Asafortidæ	asafortida, in select tears 4.
Chloroformi	tragacanth powd. 1; chloroform 4.
	expressed oil of almond 6.
Olei Morrhuæ	cod liver oil 50; oil of gaultheria 0.4; acacia 12.5; syrup 10.
Olei Morrhuæ cum Hypophosphitibus	cod liver oil 50; oil of gaultheria 0.4; syrup 10; calcium hypophosphite 1; potassium and sodium hypophosphites 0.5
Olei Terebinthinæ	rectified oil of turpentine 15.
	expressed oil of almond 5; syrup 25; acacia 15.

Unofficial Emulsions of the National Formulary.

Emulsions should, of all pharmaceuticals, be prepared within a reasonable period previous to the time of dispensing. A true emulsion should contain the oil simply suspended in the form of a mechanical mixture, which, from its very character, cannot withstand the effects of variation in temperature any better than a

natural emulsion, such as milk or emulsions of almonds, gum-resins, etc., and consequently quickly degenerates or spoils.

An emulsion may be perfect—that is, the oil-globules entirely extinguished—yet a separation similar to that occurring in milk will take place, which, though in its first stage not so objectionable, will eventually impair the medicinal value of the preparation. These reasons are, it is believed, sufficient to condemn the various "ready-made" or patent emulsions, and to justify the physician in prescribing such as are kept on hand by the pharmacist, in smaller quantities, prepared according to these formulas.

A typical formula for emulsions, with Acacia, is—

R. Olei Morrhue 120 Cc., ̄iv;
 Acaciæ pulv. 30 Gm., ̄j;
 Aquæ q. s. ad 240 Cc., ̄viii.

Emulsify by trituration in a mortar, and add the flavoring.

The following are flavors employed: (1) Gaultheria, (2) gaultheria and sassafras, (3) aromatic spirit, (4) gaultheria, bitter almond, and coriander, (5) gaultheria, sassafras, and bitter almond, (6) gaultheria and bitter almond, (7) oil of neroli, bitter almond, and cloves. Unless otherwise specified, that designated as No. 5 may be employed in these Emulsions.

The following formulas may be useful as indicating the form of prescription for any combination desired. Hypophosphite Salts or any medication desired may usually be dissolved in the water directed in the formula, should a preparation be indicated different from any of the following emulsions of the N. F.:

Emulsio—

OLEI MORRHUE CUM CALCII ET SODII PHOSPHATIBUS.—Calcium Phosphate, Sodium Phosphate, of each, 1 grain in 1 fluidrachm (0.06 in 4 Cc.).

OLEI MORRHUE CUM CALCII LACTOPHOSPHATE.—Calcium Lactophosphate, 3 grains in 1 fluidrachm (0.2 in 4 Cc.).

OLEI MORRHUE CUM CALCII PHOSPHATE.—Calcium Phosphate, 2 grains in 1 fluidrachm (0.12 in 4 Cc.).

OLEI MORRHUE CUM EXTRACTO MALTI.—Contains 40 per cent. Extract of Malt.

OLEI MORRHUE CUM HYPOPHOSPHITE.—The Hypophosphite Salt or any combination of the following: Calcium, Potassium, Sodium, or Iron, to be directed by the prescriber, 8 grains to the fluidounce (0.5 in 30 Cc.).

Emulsio—

OLEI MORRHUÆ CUM PRUNO VIRGINIANA.—Wild Cherry (Fluid Ext.), $\frac{1}{2}$ fluidrachm to 1 fluidounce (2 Cc. in 30 Cc.).

OLEI RICINI.—1 fluidounce (30 Cc.) contains $2\frac{1}{2}$ fluidrachms (10 Cc.) Castor Oil, disguised by the addition of Vanilla.

OLEI TEREBINTHINÆ.—Contains 1 fluidrachm (4 Cc.) Oil of Turpentine 1 fluidounce (in 30 Cc.), prepared according to the following formula:

R. Olei Terebinthinæ ℥iv, 12.5 Cc.;
 Acaciæ pulv. gr. xxx, 2.0
 Vitelli Ovi (Egg-yolk);
 Elixir Aromatici ana ℥iv, 15 Cc.;
 Aquæ Cinnamomi . . q. s. ad ℥iv, 100 Cc.

Make an emulsion by trituration in a mortar.

PHOSPHATICA (Phosphatic Emulsion).—Prepared with Glycerite of Egg-yolk, and contains in 1 fluidounce (30 Cc.) Cod Liver Oil, 2 fluidrachms (8 Cc.); Dilute Phosphoric Acid, $22\frac{1}{2}$ minims (1.5 Cc.); Jamaica Rum, flavored with Bitter Almond and Orange Flower Water.

EXTRACTIVE PREPARATIONS.

THE active medicinal constituents, or principles, of crude drugs are obtained by extraction. Extraction is effected either by maceration, expression, and filtration or straining, or by maceration with heat, when it is called digestion, or by percolation. The liquid employed, termed menstruum (pl. menstrua), may be Water or Alcohol, or Alcohol and Water in various proportions, sometimes with Glycerin. A few drugs require alkaline menstrua, some acid menstrua, while the oleoresins are made with Acetone (except Cubeb, which is made with Alcohol).

The Infusions and Decoctions are the simplest preparations made by extraction, and represent most nearly all the soluble constituents of the drugs. But not all drugs are adapted to this method of extraction nor to this exceedingly effective, though not especially elegant, form of exhibition. Also infusions and decoctions spoil easily unless alcohol is added as a preservative.

The most generally convenient and effective class of extractive preparations are the Tinctures. They are the simplest form of alcoholic preparations, and the other more concentrated preparations are

usually first obtained as tinctures and then concentrated by evaporation, so as to yield the fluidextract, extract, or resin respectively.

INFUSA—INFUSIONS.

Unless otherwise directed, Infusions are prepared by the general official process:

The substance, coarsely comminuted 5 Gm.

Boiling Water	100 Cc.
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Pour the boiling Water on the Drug, in a suitable vessel provided with a cover, and let it stand for half an hour; strain with expression and add enough Water through the strainer to make 100 Cc.

Caution.—The strength of Infusions of energetic or powerful substances should be especially prescribed. The following Infusions are official, being prepared of different strengths and by other processes than directed in the general formula.

См. 100 Сс.

Infusum Digitalis . alcohol 10; cinnamon water 15; digitalis 1.5

Infusum Sennæ Comp. (Black Draught), . . . fennel 2; senna 6.

mannan, magnesium sulph., of each 12.

To allow the *emulsin* and *amygdalin* of wild cherry to react, with the production of hydrocyanic acid and oil of bitter almonds, the drug must first be macerated with cold water, and is then extracted by percolation.

Gr. in 100 Cr.

Infusum Pruni Virginianæ wild cherry 4

Unofficial Infusions of the National Formulary.

Infusum—

BRAYERÆ (U. S. P. 1880).—Brayera (Cusso), 6; Boiling Water, 100 Cc. To be dispensed without straining the mixture.

GENTIANÆ COMPOSITUM FORTIUS.—For preparing Infusum Gentianæ Compositum by mixing 1 volume with 3 volumes of water.

ROSE COMPOSITUM (Compound Infusion of Rose, Ph. Br.).—
An infusion of Red Rose in diluted Sulphuric Acid, Sugar,
and Water.

The Species (Teas) are mixtures of drugs contused or bruised for the preparation of Cataplasms; or Infusions and Decoctions, sometimes designated as *Hauftus* (Draught). The following are in the National Formulary:

Species—

EMOLLIENTES (Emollient Cataplasma, Ph. Ger.).—A mixture of Althæa Leaves, Mallow Leaves, Melilot Tops, Matricaria, and Flaxseed, equal parts of each.

LAXANTES (St. Germain Tea, Ph. Ger.).—A mixture of Senna, Elder-flowers, Fennel, Anise, and Potassium Bitartrate.

PECTORALES (Breast Tea, Ph. Ger.).—A mixture of Althæa, Coltsfoot, Glycyrrhiza, Anise, Mullein Flowers, and Orris Root.

Infusum Pectorale (Pectoral Infusion, or Infusion of Pectoral Species) is made by infusing 1 troy ounce (30 Gm.) of the above in the usual manner, so as to obtain 10 fluid-ounces (300 Cc.) of strained product.

DECOCTA—DECOCTIONS.

Unless otherwise directed, Decoctions are prepared according to the following general process:

The substance, coarsely comminuted 5 Gm.
Water, to make 100 Cc.

Pour the Water on the Drug, contained in a suitable vessel provided with a cover, bring it to a boil, and let it boil for fifteen minutes; let it cool to 40° C. (104° F.), express, strain, and add cold Water through the strainer to make 100 Cc.

Caution as with Infusions.

There are no official decoctions.

DECOCTUM ALOES COMPOSITUM, N. F., is a mixture of Ext. Aloes, Myrrh, Saffron, Potass. Carb., Ext. Glycyrrh., Tinct. Cardamom Comp., and Water.—*Extempore*.

ACETA—VINEGARS.

The Vinegars are made by extraction with Dilute Acetic Acid.

By maceration:

Acetum— Gm in 100 Cc.
Opil (Black Drop) . sugar 20; nutmeg 3; powd. opium 10.
Scilla: squill 10.

VINA—WINES.

The Wines are made by solution, by maceration, or by maceration and percolation. The Menstruum is White Wine (except in Wine of Coca) with or without the addition of Alcohol (added to aid in the extraction and the preservation). There are ten Wines official.

The Natural Wines: Vinum Album and Vinum Rubrum are treated under *Alcohol*.

Vinum—

Gm. in 100 Cc.

Antimonii	antimony, potass. tart.	0.4
Cocæ	(made with red wine) fluidextract	6.5
Colchici Seminis	colchicum seed	10.
Ergotæ	ergot	20.
Ferri	iron and ammonium citrate	4.
	syrup 10; tinct. sweet orange peel	6.
Ferri Amarum	soluble iron and quinine citrate	5.
	(Bitter Wine of Iron) tinct. sweet orange peel 6; syrup	30.
Ipecacuanhæ	alcohol 10; fluidext. ipecac	10.
Opi	cinnamon, cloves, each, 1; opium	10.

The *Dose* of the Vinegar and Wine of Opium is the same, 10 minims (0.6) representing 1 grain (0.06) *opii pulvis*. The dose of the Wine of Colchicum Seed is 30 minims (2 Cc.).

Unofficial Wines of the National Formulary.

The Wines, with a few exceptions, are prepared with White Wine (*Vinum album*, U. S.), usually with the addition of 10 per cent. of Alcohol, in order better to preserve the preparation.

Vinum—

ALDES (U. S. P. 1880).—Representing 6 per cent. of Aloes with Aromatics.

AURANTII.—Sherry Wine flavored with Orange.

AURANTII COMPOSITUM (Elixir Aurantiorum Compositum).—A combination of Bitter Orange Peel, Absinthium, Menyanthes, Cascarilla, Cinnamon, and Gentian, in Sherry Wine. Useful as a stomachic tonic in doses of 1 fluidrachm (4 Cc.).

CARNIS (Beef and Wine).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Extract of Beef.

The Extract of Beef in this and similar preparations is that which is prepared by Liebig's method.

CARNIS ET FERRI (Beef, Wine, and Iron).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) of Extract of Beef and 2 minims (0.12) Tincture of Citro-chloride ("Tasteless" Tincture) of Iron.

CARNIS, FERRI ET CINCHONÆ (Beef, Wine, Iron, and Cinchona).—Each fluidrachm (4 Cc.) represents 2 grains (0.12) Extract of Beef, 2 minims (0.2) Tincture Citro-chloride of Iron, and small quantities of Cinchona alkaloids, in Angelica Wine.

COCÆ (ERYTHROXYLI).—Each fluidounce (30 Cc.) represents 30 grains (2 Gm.) of Coca in Claret Wine.

Vinum—

COCÆ AROMATICUM.—Each fluidounce (30 Cc.) represents 30 grains (2 Gm.) of Coca with Aromatics.

FRAXINI AMERICANÆ (White Ash).—Each fluidrachm (4 Cc.) represents 30 grains (2 Gm.) of Fraxinus (bark).

PEPSINI (Pepsin).—Each fluidrachm (4 Cc.) represents 1 grain (0.06) of Pepsin.

PICIS (Tar).—A saturated solution of Tar, in Sherry Wine.

PRUNI VIRGINIANÆ (Wild Cherry).—Each fluidrachm (4 Cc.) represents 15 grains (1 Gm.) of Wild Cherry, in Angelica Wine.

PRUNI VIRGINIANÆ FERRATUM (Wild Cherry, Ferrated).—Each fluidrachm (4 Cc.) represents 5 minims (0.3 Cc.) of Tincture of Citro-chloride of Iron and $13\frac{1}{2}$ grains (0.9 Gm.) of Wild Cherry, in Angelica Wine.

RHEI (U. S. P. 1880).—Representing 10 per cent. of Rhubarb and 1 per cent. of Calamus.

TINCTURÆ—TINCTURES.

Tinctures are liquid preparations made by the extraction of Drugs with menstrua of Alcohol and Water in various proportions. They are prepared by maceration and filtration or by percolation (the tinctures of iodine and nux vomica are made by simple solution).

In the Eighth Decennial (1905) Revision of the United States Pharmacopœia a number of the tinctures have been changed in strength to correspond with the tinctures used in other countries. For the following, also, assay processes have been introduced: Aconite, Belladonna Leaves, Cinchona, Colchicum Seed, Hydrastis, Hyoscyamus, Iodine, Nux Vomica, Opium, Deodorized Opium, Physostigma, and Stramonium.

Tincturæ Herbarum Recentium.—Tinctures of Fresh Herbs, or "Green Tinctures," similar to the Homœopathic or so-called "German Tinctures," also to the specific tinctures of the Eclectics, when not otherwise directed are to be prepared by the following general formula:

Take of the fresh herb, cut, bruised, or crushed, 50 Gm.; macerate for fourteen days in Alcohol 100 Cc., express the liquid and filter

Tinctures of the U. S. P.

			U. S. P.			
Tinctura—	Name.	Drug.	Gm. in 100 Gr.	Menstrua. Alcohol, per cent.	Average Dose.	
					Gt.	Min.
Aconiti	Root	10	70	0.6	10	
Aloes	Aloes	10	50	2.	30	
	Licorice	20				
Aloes et Myrrhæ	Aloes	10	75	2.	30	
	Myrrh	10				
	Licorice	10				
Arnica	Flowers	20	50	1.	15	
Asafetida	Gum resin	20	100	1.	15	
Aurantii Amari	Bitter Orange peel	20	60	4.	60	
Aurantii Dulcis	Sweet	50	100	4.	60	
Belladonnae Foliorum	Leaves	10	50	0.5	8	
Benzoini	Balsam	20	100	1.	15	
Benzoini Composita (Turlington's Bal- sam).	Benzoin	12	100	2.	30	
	Storax	8				
	Tolu	4				
	Aloes	2				
Calendula	Florets	20	100	■	30	
Calumba	Root	20	60	4.	60	
Cannabis Indica	Flower tops	10	100	0.6	10	
Cantharidis	Insect	10	100	0.3	5	
Capsici	Fruit	10	95	0.5	8	
Cardamomi	Fruit	20	50	4.	60	
Cardamomi } Composita }	Cardamom	2.5	50	4.	■	
	Saigon Cinnam.	2.5				
	Caraway	1.2				
	Cochineal	0.5				
	Glycerin	5				
Cimicifuga	Rhizome	20	100	4.	60	
Cinchona	Bark	20	67	4.	60	
Cinchona Composita (Huxham's Tinc- ture).	Red Cinchona	10	67	4.	60	
	Bitter Orange peel	8				
	Serpentaria	2				
	Glycerin	7.5				
Cinnamomi	Saigon	20	67	2.	30	
Colchici Seminis	Seed	10	60	2.	30	
Digitalis	Leaves	10	50	1.	15	
Ferri Chloridi	Solution	35 Cc.	65	0.5	8	
Galla	Nutgall.	20	90	4.	60	
Gambir Composita	Gambir	5	50	4.	60	
	Saigon Cinnam.	2.5				
Gelsemii	Root	10	65	0.5	8	
Gentiana Composita	Gentian	10	60	4.	60	
	Bitter Orange peel	4				
	Cardamom	1				
Guaiaci	Resin	20	100	4.	60	
Guaiaci Ammoniatæ	Resin	20	.	2.	30	
Hydrastis	Rhizome	20	65	4.	60	
Hyoscyami	Herb.	10	50	1.	15	

TEXT-BOOK OF MATERIA MEDICA.

Drug.	Gm. in 100 Grs.	Menstrum. Alcohol, per cent.	U. S. P. Average Dose.	
			Gr.	Mm.
{ Iodine	7 }	100	0.1	1½
{ Potass. Iodide	5 }			
Opil { Ipecac	10 }	50	0.5	■
{ Opium deod.	10 }			
. Insp. juice	5	65	4	60
. Rhatany	20	50	4	60
. Insp. juice	50	50	2	30
posita { Oil Lavender	0.8 }	75	2	30
	Oil Rosemary			
	Cinnamon			
	Cloves			
	Nutmeg			
. Red Saunders	1.			
is Fresh peel	50	100		
. Herb	10	50	{ 1.	15¹
. Musk	5	50	4.	60¹
. Gum resin	20	100	1.	15
. Extract	2	75	0.6	10
. Gran. Opium	10	50	0.5	8
. { Opium pulv.	0.4 }	50	8.	120
	Acid Benzoic			
	Camphor			
	Oil Anise			
	Glycerin			
. Gran. Opium	10	■	0.5	8
. Calabar Bean	10	100	1.	15
. Pellitory	20	100		
. Wood	20	35	2.	30
. Soap Bark	20	35		
. { Rhubarb	20 }	50	4.	60
	Cardamom			
	Glycerin			
. { Rhubarb	20 }	50	2.	30
	Cinnamon			
	Cloves			
	Nutmeg			
	Glycerin			
. Blood-root	10	60	1.	15
. Squill	10	75	1.	15
. Rhizome	20	65	4.	60
. Leaves	10	50	0.5	8
. Seed	10	65	0.5	8
. Tolu	20	100	2.	30
. Root	20	75	4.	60
montana Root	20	.	2.	30
. Fruit	10	65		
. Rhizome	10	100	■	15
. Ginger	20	100	■	30

¹ Expectorant.

² Emetic.

*Unofficial Tinctures of the National Formulary.***Tinctura**—

AMARA (Bitter Tincture, Ph. Ger.).—Containing Gentian, Centaury, Bitter Orange Peel, Orange Berries, and Zedoary.

ANTACRIDA (Dysmenorrhœa Mixture; Fenner's Guaiac Mixture).—A mixture of Guaiac, Canada Turpentine, Oil of Sassafras, and $\frac{1}{2}$ grain (0.02) Corrosive Mercuric Chloride in each fluidrachm (4 Cc.). *Dose*, from 10 to 20 minims (0.6 to 1.3 Cc.).

ANTIPIRIODICA (Warburg's Tincture).—*With Aloes*: Rhubarb, Angelica Seed, of each, grains 56 (4.); Elecampane, Saffron, Fennel, of each, grains 28 (2.); Aloes (aq. ext.), Gentian, Zedoary, Cubeb, Myrrh, White Agaric, Camphor, of each, grains 14 (1.); Quinine Sulphate, grains 160 (10.); Diluted Alcohol, enough to make fluidounces 16 (473 Cc.).

ANTIPIRIODICA (Warburg's).—The preceding *without Aloes*. Each fluidounce (30 Cc.) of either tincture contains 10 grains (0.6) of Quinine Sulphate.

AROMATICA (Stomachic, Ph. Ger.).—A combination of Cinnamon, Ginger, Galangal, Cloves, and Cardamom.

CAPSICI ET MYRRHÆ (Hot Drops).—The preparation popularly known as "Number Six."

CINCHONÆ DETANNATÆ.—For admixture with preparations containing Iron.

CONII (U. S. P. 1880).—Representing 15 per cent. of Conium.

COTO.—This preparation contains $7\frac{1}{2}$ grains (0.5) true Bolivian Bark in each fluidrachm (4 Cc.). The Para Coto, frequently employed, differs considerably from the above.

FERRI CHLORIDI ÆTHEREA (Bestucheff's Tincture; Lamott's Drops, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $\frac{1}{2}$ grain (0.3) Metallic Iron.

FERRI CITRO-CHLORIDI (Tasteless Tincture of Iron).—Practically identical in the strength of Iron, but not in Alcohol, with the official Tincture of Chloride of Iron, containing an amount of Iron equivalent to $7\frac{1}{2}$ grains (0.5) of Dry Chloride of Iron in each fluidrachm (4 Cc.).

A convenient form of Iron for admixture with Tinctures of vegetable astringent drugs, such as Gentian and Cinchona, preparations of which it does not, unlike other iron compounds, discolor.

FERRI POMATA (Ferrated Extract of Apples; Malate of Iron, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $\frac{1}{2}$ grain (0.025) of Metallic Iron.

Tinctura—

GUAIACI COMPOSITA (Dewees' Tincture of Guaiac).—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) Guaiac.

IGNATIÆ (U. S. P. 1880).—Representing 10 per cent. of Ignatia.

IODI (Churchill's).—A solution of 10 grains (0.6) Iodine in each fluidrachm (4 Cc.), with Potassium Iodide in Alcohol.

Not to be confounded with Churchill's Iodine Caustic (Liquor Iodi Causticus).

IODI DECOLORATA (Colorless Tincture of Iodine).—Containing about 1 per cent. of Ammonium Iodide, with some other Iodine compounds, in alcoholic solution; for external use.

JALAPÆ (U. S. P. 1870).—Each fluidrachm (4 Cc.) represents about 10 grains (0.6) Jalap.

JALAPÆ COMPOSITA.—Each fluidrachm (4 Cc.) represents $7\frac{1}{2}$ grains (0.5) Jalap and about 2 grains (0.12) Scammony.

KINO COMPOSITA—

Tinctures of Kino, Opium, each . . .	minims 180	12.	Cc.
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Spirit of Camphor	"	130	8.5 "
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Oil of Cloves	"	$2\frac{1}{2}$	0.15 "
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Aromatic Spirit of Ammonia . . .	"	15	1. "
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Cochineal	grains 16	1.	"
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Diluted Alcohol to make fluidounces 4	120.	"	
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Each fluidrachm (4 Cc.) represents $\frac{1}{2}$ grain (0.03), each, of Kino and Opium.

PAPAVERIS (Poppy).—Each fluidrachm (4 Cc.) represents 30 grains (2.) of Poppy (Capsule).

PECTORALIS (Bateman's Pectoral Drops).—A popular mixture of Opium, Catechu, Camphor, and Oil of Anise, containing $2\frac{1}{2}$ minims (0.15) Tincture of Opium ($\frac{1}{4}$ grain Pulv. Opium) in each fluidrachm (4 Cc.).

PERSIONIS (Cudbear).—Intended as a coloring agent when a bright-red tint or color is to be produced, particularly in acid liquids.

PERSIONIS COMPOSITA.—A mixture of Cudbear and Caramel, intended as a coloring agent when a brownish-red tint or color is to be reproduced.

PIMPINELLÆ (Pimpinella, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about 10 grains (0.6) Pimpinella Root.

RHÆI AQUOSA (Rhubarb, Aqueous, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about $5\frac{1}{2}$ grains (0.4) of Rhubarb, with alkalies, flavored with Cinnamon.

Tinctura—

RHEI ET GENTIANÆ.—Each fluidram (4 Cc.) represents 5 grains (0.3) of Rhubarb and 1 grain (0.06) of Gentian.

RHEI VINOSA (Rhubarb, Vinous, Ph. Ger.).—Each fluidrachm (4 Cc.) represents about 5 grains (0.3) Rhubarb, with Bitter Orange and Cardamom, in Sweet Sherry Wine

SAPONIS VIRIDIS COMPOSITA.—A solution of about 15 per cent. of Green Soap and 2 per cent. of Oil of Cade.

TINCTURÆ ÆTHERÆÆ (Ethereal Tinctures).—The drug, properly comminuted, troy ounces 2 (60 Gm.); Stronger Ether, 1 volume; Alcohol, 2 volumes; enough to make fluid-ounces 16 (473 Cc.). A general formula for the preparation of Ethereal Tinctures of Belladonna, Castor, Digitalis, Lobelia, Valerian, and other drugs. Official in several European pharmacopœias, and sometimes prescribed by foreign physicians.

TOLUTANA SOLUBILIS (Tolu, Soluble).—A so-called soluble essence of Tolu, for flavoring.

VANILLINI COMPOSITA.—A solution of Vanillin and Coumarin, intended for flavoring.

ZEDOARIÆ AMARA (Zedoary Comp.).—Similar to, but not identical with, the Tinctura Carminativa, Wedellii, etc., formerly official in some Continental pharmacopœias.

Each fluidrachm (4 Cc.) represents 15 grains (1 Gm.) of Zedoary, $7\frac{1}{2}$ grains (0.5) of Aloes, and $3\frac{1}{2}$ grains (0.25), each, of Rhubarb, Gentian, White Agaric, and Saffron.

FLUIDEXTRACTA—FLUIDEXTRACTS.

Fluidextracts may be defined as a class of concentrated tinctures of such strength as to represent the drug, *volume for weight*. They are made by *percolation*, *maceration*, or *digestion*.

The following is the process of percolation chiefly employed :

In proceeding to percolate 100 Gm. of the drug, according to directions, the first 80 to 90 Cc. are reserved, and percolation continued until the exhaustion is completed. The weak percolate is evaporated to a soft extract (the alcohol being recovered) and dissolved in the reserved percolate. Sufficient menstruum is then added to make the product measure 100 Cc.

The Pharmacopœia gives assay processes for the Fluidextracts of Aconite, Belladonna Root, Cinchona, Coca, Colchicum Seed, Conium, Guarana, Hydrastis, Hyoscyamus, Ipecac, Nux Vomica, Pilocarpus, Scopolia, and Stramonium.

Official Name.	Drug.	Part.	U. S. P. Average Dose.	
			G.	Minims.
Fluidextractum—				
Aconiti	Aconitum Napellus.	Tuber	0.05	1
Apocyni	Apocynum Cannabinum.	Root	1.	15
Aromaticum	Pulvis Aromaticus	1.	15
Aurantii Amari	Citrus vulgaris.	Rind.	1.	15
Belladonnæ Radicis.	Atropa Belladonna	Root	0.05	1
Berberidis.	Berberis Aquifolium	Rhizome	2.	30
Bachu	Barosma betulina	Leaves	2.	30
Calami	Acorus Calamus	Rhizome	1.	15
Calumbæ	Jateorrhiza palmata	Root	2.	30
Cannabis Indicæ	Cannabis sativa	Fl. Tops	0.05	1
Capsici	Capaicum fastigiatum	Fruit	0.05	1
Chimaphilæ	Chimaphila umbellata	Leaves	2.	30
Chiracæ	Sweetia Chirata	Plant.	1.	15
Cimicifugæ	Cimicifuga racemosa	Rhizome	1.	15
Cinchonæ	Cinchona Calisaya	Bark	1.	15
Cocæ	Erythroxylon Coca	Leaves	2.	30
Colchici Seminis	Colchicum autumnale	Seed	0.2	3
Conii	Conium maculatum.	Fruit	0.2	3
Convallariæ	Convallaria majalis	Rhizome	0.5	8
Cubebæ	Piper Cubeba	Fruit	1.	15
Cypripedii	Cypripedium pubescens	Rhizome	1.	15
Digitalis	Digitalis purpurea	Leaves	0.05	1
Ergotæ	Claviceps purpurea	Sclerotium	2.	30
Enodietyi	Enodietyon glutinosum	Leaves	1.	15
Eucalypti	Eucalyptus globulus	Leaves	2.	30
Euonymi	Euonymus atropurpureus	Bark	0.5	8
Eupatori	Eupatorium perfoliatum	Herb	2.	30
Frangulæ	Rhamnus Frangula	Bark	1.	15
Gelsemii	Gelsemium sempervirens	Rhizome	0.05	1
Gentianæ	Gentiana lutea	Root	1.	15
Gerani	Geranium maculatum	Rhizome	1	15
Glycyrrhizæ	Glycyrrhiza glabra	Root	2	30
Granati	Punica Granatum	Bark	2.	30
Grindeliæ	Grindelia robusta	Leaves	2.	30
Guaranæ	Paullinia Cupana	Seeds	2.	30
Hamamelidis Folium crum	Hamamelis Virginiana	Leaves	2.	30
Hydrastis	Hydrastis Canadensis	Rhizome	2.	30
Hyoscyami	Hyoscyamus niger	Herb	0.2	3
Ipecacuanhæ	Cephaelis Ipecacuanha	Root		
		Emetic	1.	15
		Expectorant	0.05	1
Kramerizæ	Krameria triandra	Root	1.	15
Lappæ	Arctium Lappa	Root	2.	30
Leptandrzæ	Veronica Virginica	Rhizome	1	15
Lobeliæ	Lobelia inflata	Herb	0.5	8
Lupulinæ	Humulus Lupulus	Powder	0.5	8
Matico	Piper angustifolium	Leaves	4.	60

Official Name.	Drug.	Part.	U. S. P. Average Dose.	
			Gr.	Minims.
Fluidextractum—				
Meserei	Daphne Mezereum	Bark		
Nucia Vomice	Strychnos Nux-vomica	Seed	0.05	1
Pareira	Chondodendrum tomentosum	Root	2.	30
Phytolacce	Phytolacca decandra	Root :		
		Emetic	1.	15
		Alterative	0.1	1½
Pilocarpi	Pilocarpus Jaborandi	Leaves	2.	30
Podophylli	Podophyllum peltatum	Rhizome	0.5	8
Pruni Virginianæ	Prunus serotina	Bark	2.	30
Quassia	Picras excelsa	Wood	0.5	8
Quercus	Quercus alba	Bark	1.	15
Quillajæ	Quillaja saponaria	Bark	0.2	3
Rhamni Purshianæ	(Cascara sagrada)	Bark	1.	15
Rhamni Purshianæ	Rhamnus Purshiana,			
Aromaticum	Glycyrrhiza,			
	Compound spirit of orange }		1.	15
Rhei	Rheum officinale	Root	1.	15
Rhois Glabræ	Rhus glabra	Leaves	1.	15
Rosæ	Rosa Gallica	Petals	2.	30
Rubi	Rubus villosus	Root Bark	1.	15
Sabinæ	Juniperus Sabina	Tops	0.3	5
Sanguinariæ	Sanguinaria Canadensis	Rhizome	0.1	1½
Sarsaparillæ	Smilax officinalis, etc.	Root	2.	30
Sarsaparillæ Com- positum	{ Sarsaparilla, 75 Glycyrrhiza, 12 Sassafras, 10 Mezereum, 3 }		2.	30
Scillæ	Urginea maritima	Bulb	0.1	1½
Scopolæ	Scopola Carniolica	Rhizome	0.05	1
Scutellarie	Scutellaria lateriflora	Herb	1.	15
Senegæ	Polygala Senega	Root	1.	15
Sennæ	Cassia acutifolia and angustifol.	Leaves	2.	30
Serpentariæ	Aristolochia Serpentaria	Rhizome	1.	15
Spigeliæ	Spigelia Marilandica	Rhizome	4.	60
Staphisagrie	Delphinium Staphisagria	Seed	0.05	1
Stillingiæ	Stillingia sylvatica	Root	2.	30
Stramonii	Datura Stramonium	Leaves	0.05	1
Sumbul	(undetermined)	Rhizome	2.	30
Taraxaci	Taraxacum officinale	Root	8.	120
Tritici	Agropyrum repens	Rhizome	8.	120
Uvæ Ursi	Arctostaphylos Uva Ursi	Leaves	2.	30
Valerianæ	Valeriana officinalis	Rhizome	2.	30
Veratri	Veratrum viride	Rhizome	0.1	1½
Viburni Opuli	(Cramp bark)	Bark	2.	30
Viburni Prunifolii	(Black haw)	Bark	2.	30
Xanthoxyli	Xanthoxylum Americanum	Bark	2.	30
Zingiberis	Zingiber officinale	Rhizome	1.	15

Unofficial Fluidextracts of the National Formulary.

Unless otherwise indicated, the dose of the following Fluid-extracts is from $\frac{1}{2}$ to 1 fluidram (2 to 4 Cc.):

Fluidextractum—

- ADONIDIS.**—Root of *Adonis vernalis* L. (Bird's Eye).
ALETROIDIS.—Rhizome of *Aletris farinosa* L. (Stargrass).
ANGELICÆ RADICIS.—Root of *Archangelica* L. (Angelica).
APII GRAVEOLENTIS.—Seed of *Apium graveolens* L. (Celery).
ARALIÆ RACEMOSÆ.—Root of *Aralia racemosa* L. (American Spikenard).
ARNICÆ FLORUM.—Flower heads of *Arnica montana* L. (Arnica).
BERBERIDIS VULGARIS.—Bark of the root of *Berberis vulgaris* L. (Barberry).
BOLDI.—Leaves of *Peumus Boldus* Molina (Boldo).
BUCHU COMPOSITUM.—A combination of Buchu, 10; Cubeb, 2; Juniper, 2; Uva Ursi, 2 parts.
CALENDULÆ.—Flowering herb of *Calendula officinalis* L. (Marigold).
CAMELLIÆ.—Leaves of *Camellia Thea* Link (Tea). The best quality of commercial black tea, "Formosa Oolong," to be employed for this preparation.
CAULOPHYLLI.—Rhizome and rootlets of *Caulophyllum thalictroides* Mich. (Blue Cohosh).
COFFÆÆ VIRIDIS.—Unroasted seeds of *Coffea Arabica* L.
COFFÆÆ TOSTÆ.—Roasted seeds of *Coffea Arabica* L.
 The N. F. recommends equal portions of Java and Mocha to be employed in preparing the Fluid Extracts of Coffee.
CONVALLARIÆ FLORUM.—Flowers of *Convallaria majalis* L. (Lily of the Valley).
COPTIS.—Rhizome of *Coptis trifolia* Salisb. (Goldthread).
CORNUS CIRCINATÆ.—Bark of *Cornus circinata* L'Hér. (Green Osier).
CORNUS FLORIDÆ (U. S. P. 1880).—Dogwood Bark.
CORYDALIS.—Tubers of *Dicentra Canadensis* De C. (Turkey Corn).
COTO.—Coto bark, undetermined tree. *Dose*, from 5 to 15 minims (0.3 to 1 Cc.).
FUCI.—Thallus of *Fucus vesiculosus* L. (Bladder-wrack).

Fluidextractum—

HELIANTHEMI.—Herb of *Helianthemum Canadense* Mich. (Frost-wort).

HUMULI.—Strobles of *Humulus Lupulus* L. (Hops).

HYDRANGÆ.—Root of *Hydrangea arborescens* L. (Seven Barks).

JALAPÆ.—Tuber of *Exogonium purga* Benth. (Jalap). *Dose*, from 15 to 20 minims (1 to 1.3 Cc.).

JUGLANDIS.—Bark of the root of *Juglans cinerea* L. (Butternut).

JUNIPERI.—Fruit of *Juniperus communis* L.

KAVA.—Root of *Piper methysticum* Forster (Kava; Kava-Kava).

LACTUCARII (U. S. P. 1880).—Insp. juice of *Lactuca virosa* L.

MALTI.—(Fluid Extract of Malt).

MENYANTHIS.—Leaves of *Menyanthes trifoliata* L. (Buckbean; *Trifolium fibrinum*, Ph. G.).

MEZEREI (U. S. P. 1880).—Bark of *Daphne Mezereum* L. *Dose*, from 5 to 10 minims (0.3-0.6 Cc.).

PETROSELINI RADICIS.—Root of *Petroselinum sativum* Hoffman (Parsley).

QUILLAJÆ.—Bark of *Quillaja Saponaria* Molina (Soap Bark).

RHAMNI PURSHIANÆ AROMATICUM.—*Cascara Sagrada* deprived of its bitter taste.

RHEI AROMATICUM.—A combination of Rhubarb, Cinnamon, Cloves, and Nutmeg.

SENNÆ DEODORATUM (Aqueous Fluid Extract of Senna).—This preparation is free from the objectionable "griping" qualities of the ordinary fluid extract.

STERCULIÆ.—Seeds of *Sterculia acuminata* R. Brown (Cola or Kola).

STILLINGIÆ COMPOSITUM (Stillingia Comp.).—*Stillingia*, *Corydalis*, each, 4 parts; *Iris*, *Sambucus*, *Chimaphila*, each, 2 parts; *Coriander*, *Xanthoxylum* Berries, each, 1 part.

TRILLII.—Rhizome of *Trillium erectum* L. (Bethroot).

TURNERÆ.—Leaves of *Turnera microphylla* De C. (Damiana).

URTICÆ.—Root of *Urtica dioica* L. (Nettle).

VERBASCI.—Leaves (and flowers) of *Verbascum Thapsus* L.

VERBENÆ.—Root of *Verbena hastata* L. (Vervain).

ZÆ.—*Stigmatum Maydis*; Corn Silk; *Stigmata* of *Zea Mays* L. (Indian Corn).

EXTRACTA—EXTRACTS.

Extracts—or "solid" extracts, as they are termed, to distinguish them from fluidextracts—are the soluble principles of vegetable drugs, extracted and concentrated by evaporation to a soft solid or a plastic mass of pilular consistence, or dried and reduced to powder.

Table Showing the Drug-strength and the Average Doses of the Official Extracts.

Extractum.	Part	Parts of Drug in 1 part of Extract (Approximate.)	Dose of Extract	
			Grains.	Grm.
Aloes (aqueous)		2	2	0.125
Belladonnæ Fol.	Leaves	5	$\frac{1}{2}$	0.01
Cannabis Indica	Herb	10	$\frac{1}{2}$	0.01
Cimicifuge	Rhizome	10	4	0.25
Colchici Cormi (acetic)	Corm	3	1	0.065
Colocynthis (powder)	Fruit	6	$\frac{1}{2}$	0.03
Colocynthis Compositum (powder)	Ext. Colocynth, 16, Cardamom, 6; Aloes, 50; Soap, Scammony, each, 14.		7 $\frac{1}{2}$	0.5
Digitalis	Leaves	4	$\frac{1}{2}$	0.01
Figitæ	Sclerotium	8	4	0.25
Eucynni	Bark	4	2	0.125
Gentianæ (aqueous)	Root	4	4	0.25
Glycyrrhizæ (stick)	Root	3	15	1.
Glycyrrhizæ Purum (ammon.)	Root	3	15	1.
Hæmatoxyli (aqueous)	Logwood	4	15	1.
Hyoscyami	Herb	6	1	0.065
Krameriæ (aqueous)	Root	5	7 $\frac{1}{2}$	0.5
Leptandriæ	Root	4	4	0.25
Malti	Liquid		3iv	16 Cc
Nucis Vomice (powder)	Seed	10	$\frac{1}{2}$	0.015
Opii (powder)		1 $\frac{1}{2}$	$\frac{1}{2}$	0.03
Physostigmatis	Calabar bean	20	$\frac{1}{2}$	0.008
Quassia (aqueous)	Wood	10	1	0.065
Rhamni Purshianæ	Bark	4	4	0.25
Rhei	Root	3	4	0.25
Scopolinæ	Rhizome	5	$\frac{1}{2}$	0.01
Stramoni	Leaves	10	$\frac{1}{2}$	0.01
Sumbul	Rhizome		4	0.25
Taraxaci (aqueous)	Root	3	15	1.

The *strength* of an extract depends upon the amount of the crude drug it represents. Hence, the *smaller* the percentage of extract obtained from a drug, the *greater* the relative strength of the extract, provided that the drug be exhausted with menstrua adapted to secure all the active principles in this form.

The yield of extract is influenced by the character of the menstruum employed. As a general rule, the more *aqueous* the men-

strua, the *greater* the yield of extract; conversely, the more *alcoholic* the menstrua, the *smaller* the yield of extract. To obtain the extracts, therefore, of official *strength* it is necessary to use official *menstrua* in the extraction.

Thus the extracts of different drugs are as many times stronger than the drug as the quotient obtained by dividing the drug at 100 by the percentage yield. For example: Podophyllum yields 10 per cent. of extract; then $100 \div 10 = 10$; that is, the extract is ten times as strong as the drug and the fluid extract, or 0.1 of the extract represents 1 Gm. of the drug or 1 Cc. of the fluid extract. The drug-strengths of the official Extracts, calculated by this method, as well as their relative doses based upon the amounts of drug they represent, are exhibited in the table given on page 109.

The official Extracts are made by extraction with alcoholic menstrua or with water, sometimes by the addition of *acid* or *alkali*.

The Extracts of Cimicifuga, Colocynth, Colocynth Compound, Euonymus, Leptandra, Nux Vomica, Opium, Physostigma, Quassia, and Rhamnus Purshiana, are in powdered form; the others are of *pilular* consistence.

The Pharmacopœia gives assay processes for the following extracts: Belladonna Leaves, Colchicum Corm, Hyoscyamus, Nux Vomica, Opium, Physostigma, Scopola, and Stramonium.

EXTRACTUM FERRI POMATUM, N. F.—Ferri Malas Crudus (Fermented Extract of Apples, Ph. Ger.).

EXTRACTUM GLYCYRRHIZÆ DEPURATUM, N. F.—Succus Liquiritiæ, Ph. Ger. (Purified Extract of Liquorice).

OLEORESINÆ—OLEORESINS.

To natural Oleoresins, derived as plant-exudations, belong the Turpentine and the Pitches. From similar exudations are obtained the Gum Resins, mixtures of Gum and Resins and sometimes Volatile Oils; also the Balsams, which are Resins or Oleoresins associated with Benzoic or Cinnamic Acid. These are treated under their respective Drugs.

The *pharmaceutical* Oleoresins are semi-liquid extracts, obtained by exhausting oleoresinous drugs with acetone (alcohol is employed in the manufacture of Oleoresin of Cubebs).

These extracts *fix* and *volatile oils* and *resin*; these principles constitute therefore the oleoresins, which sometimes also contain other active matter in solution or suspension.

The six following are official :

Oleoresina—	Gm.	Gr.
Aspidii; separates in two layers, to be mixed when used	2.	30
Capsici; separates fat, used only as corrective	0.03	$\frac{1}{2}$
Cubebæ; separates wax	0.5	$7\frac{1}{2}$
Lupulini	0.2	3
Piperis; separates piperine, to be rejected	0.03	$\frac{1}{2}$
Zingiberis	0.03	$\frac{1}{2}$

RESINÆ—RESINS.

The official Resins may be divided into the (1) Natural Resins, (2) Resins obtained from Oleoresins by separating the Volatile Oil by distillation, and (3) the Pharmaceutical Resins, prepared by *precipitation*.

When a concentrated tincture of a resinous drug is poured into a large quantity of cold water, the resinous matter becomes insoluble and is precipitated; this, after being washed, dried, and sometimes powdered, is termed a *resin*.

Resins are usually *soluble* in alkalis and *insoluble* in acids (dilute); for this reason the water used for precipitation is sometimes rendered slightly acid to favor the separation.

The three following are official :

Resina—	Per cent yield from Drug. About	Dose.	
		Gm.	Gr.
Jalapæ	15	0.125	2
Podophylli	5	purgative	
		0.015	$\frac{1}{2}$
		laxative	
Scammonii	65	0.005	$\frac{1}{10}$
		0.2	3

Resina and Resina Copaibæ are obtained as residue in the distillation of the respective Oleoresins, Turpentine and Copaiba. The natural Resins are obtained as exudates—*e. g.* R. Guaiaci.

The terms *resin*, *resinoid*, and *concentration* are also applied to a class of preparations used by eclectic physicians, prepared by this general process with some modifications. (See U. S. and Am. Disp.) They are named after their respective Drugs with the ending *in*, as in Glucosides, and must not be confused with the latter. While the Glucosides are usually the active medicinal constituents representing the drug, the resinoids, with the exception of those made

from drugs whose active principles are resins, such as *Cimicifuga* and *Podophyllum*, are more or less inert, unreliable mixtures, too indefinite in their composition and strength for medicinal use.

SOLID MIXTURES FOR INTERNAL USE.

MIXTURES of Solids for internal use embrace the following classes of preparations: Powders, Effervescent Salts, Confections, Troches, Masses, and Pills.

Powders are substances reduced to a fine pulverulent condition to favor their administration and solution or absorption. A powder may be *simple*, such as a powdered drug, *Pulvis opii*, or a powdered salt—*i. e.* *Quinine sulphas*; or it may be *compound*, a mixture of several substances.

Sparsingly soluble substances, when finely powdered (impalpable) and thoroughly mixed by trituration in a mortar with some inert powder (diluent) such as Milk Sugar, are rendered more soluble, since a greater surface is exposed to the solvent action of the liquids of the body, and prompter and fuller effects are obtained. The potency of calomel, of the resins, and of alkaloids is in this way considerably increased within certain limits, but not to the unreasonable extent advocated by Homœopathic pharmacy, in which this process is carried to a *reductio ad absurdum*. It is an excellent and convenient method for dispensing and administering the more potent agents, such as arsenous acid, mercury compounds, and the alkaloids. Substances triturated in this way have been called *Triturations*, for whose preparation the U. S. P. gives a general formula. (*Trituratio Elaterini* is the only official trituration.):

Take of the substance, for example, Elaterin . . . 1 Gm.
Milk Sugar, in fine powder 9 Gm.

First thoroughly triturate the medicinal substance (Elaterin) with an equal weight of Milk Sugar, then add the remainder of the Milk Sugar, and mix thoroughly by trituration (for about ten minutes).

Unless otherwise specified, triturations should be of the official strength—*i. e.* 10 per cent. of the drug.

By the addition of about an equal weight of Alcohol to the triturate it becomes a soft mass, which, after being moulded into disks of about 1 grain (0.06 Gm.) each, after the evaporation of the

Alcohol, furnishes the so-called *Tablet Triturates*. These afford a convenient method of medication for such substances as are adapted to trituration, which is, however, confined, as indicated, to a comparatively limited number of agents. To represent in the form of these tablets every kind of medicinal agent of volatile character, or drugs otherwise susceptible to change through the inevitable exposure to the atmosphere to which every such mixture is liable, is simply to invite error in practice. These tablets, moreover, with certain chemical substances, undergo chemical changes which render them entirely insoluble, and thus practically inert. In order to be effective and otherwise reliable, they should be prepared extemporaneously by the pharmacist, in order to ensure their solubility.

They should always be dissolved in a little water before they are administered.

When it is desired to obtain a mild and prolonged local effect of a medicinal agent in the mouth or throat, the substance is made into a soft mass (*confection*) with a diluent and excipient, Sugar and Mucilage, and flavor, and formed into round or oval-shaped disks, weighing from 8 to 30 grains ($\frac{1}{2}$ to 2 Gm.), called variously *Lozenges*, *Troches*, and *Pastils*.

Troches.—When these are allowed to dissolve slowly in the mouth the diluent serves as a vehicle for the medicinal agent, and a gradual prolonged effect is obtained upon the mucous surfaces. This form of medication is adapted only to astringents, antacids, expectorants, and stomachics consisting of substances not especially disagreeable to the palate.

Lozenges are not intended to be swallowed, nor adapted to exceedingly volatile, caustic, irritant, or otherwise unpalatable substances. For ingestion, medicinal agents should be made into a Mass (*massa*) with an excipient, and formed into small spheres, or balls, as a rule not over 5 grains (0.3 Gm.) in weight, to be swallowed and slowly dissolved in the stomach or intestines. Such preparations are the so-called *Pills* (*Pulula*, from *pila*, ball). The medicinal substance may also be divided and placed in *Gelatin Capsules* or in *Rice-flour Cachets*.

PULVERES—POWDERS.

The official Powders are impalpable mixtures of one or more active drugs, usually with some nearly inert substance, such as Sugar, as a *diluent*, and Aromatics.

They are made by trituration.

Pulvis -	Gm. in 100.
Acetanilidi Compositus . . . acetanilide 70, caffein 10. sodium bicarbonate 20.	
Aromaticus . . . cinnamon (Saigon), ginger, each 35. cardamom (seed), nutmeg, each 15.	
Cretæ Compositus . acacia p. 20; sugar 50; prep. chalk 30.	
Glycyrrhizæ Compositus . . . senna 18; glycyrrhiza 23.6 fennel oil 0.4; sulphur, washed, 8; sugar 50.	
Ipecacuanhæ et Opii . . . ipecac, opium pulv., each 10. (Dover's Powder) sugar of milk 80.	
Jalapæ Compositus . . . potass. bitartrate 65; jalap 35.	
Morphinæ Compositus . . . camphor 32; morphine (Tully's Powder) sulph. 1.5 calcium carb., precip. 33.5; glycyrrhiza p. 33.	
Rhei Compositus . magnesium oxide 65; ginger 10; rhubarb 25.	

	For 12 pots. : in each	
	Gm.	Gr.
Effervescens Compositus . . (Seidlitz Powder)		
potassium and sodium tartrate	93	120
sodium bicarbonate	31	40
acid tartaric	27	35

Many methods are in use for the purpose of disguising the taste of disagreeable remedies in the powder form. Of these the most elegant and effective method is that of enclosing the powder in a *cachet* or wafer. Originally wafers were made of starch-paste in thin sheets; a piece about 0.5 dm. (2 inches) square, immersed in water for a minute, being placed in a spoon, the powder poured into it, and then enwrapped by folding up the edges and swallowed with a little water. The *cachets* or "konseals" are wafer-disks consisting of two concentric halves, one of which is filled with the powder, and the other half attached by moistening the edge and pressing the edges together by means of various devices. These *cachets* are of three sizes, the largest holding 5 grains (0.3) Quinine Sulphate. After a moment's immersion in water they can be swallowed without any effort.

Unofficial Powders of the N. F.

Pulvis -

ACACIÆ COMPOSITUS (Pulvis Gummosus, Ph. Ger.).

ACETANILIDI COMPOSITUS.—Containing 50 per cent. Acetan-

Pulvis—

ilid, 2 per cent. Caffeine, with Tartaric Acid and Sodium Bicarbonate.

ALOES ET CANELLÆ (Hiera Picra).

AMYGDALÆ COMPOSITUS (Almonds Comp.)—A mixture of Sweet Almond, Sugar, and Acacia, in fine powder; 180 grains (10 Gm.), triturated with Water, yield about 4 fluid-ounces (119 Cc.) of Emulsum Amygdalæ.

ANTICATARRHALIS (Catarrh Snuff.)—Hydrochlorate of Morphine, 1 part; Acacia, 60 parts; Subnitrate of Bismuth, 180 parts, in fine powder.

CATECHU COMPOSITUS (Compound Powder of Catechu, Ph. Br.).—Catechu, 4 parts; Kino, 2 parts; Krameria, 2 parts; Cinnamon, 1 part; Nutmeg, 1 part.

CRETÆ AROMATICUS.—A mixture of Cinnamon, Saffron, Nutmeg, Cloves, Cardamon, prepared Chalk, and Sugar.

CRETÆ AROMATICUS CUM OPIO.—Aromatic Powder of Chalk, with 1 grain (0.06) of powdered Opium, in 40 grains (1.5) of the mixture. Official in the Ph. Br.

HYDRARGYRI CHLORIDI MITIS ET JALAPÆ (Calomel and Jalap)—A mixture of Mild Chloride of Mercury, 10 grains (0.6), and Jalap, 20 grains (1.3).

When "Calomel and Jalap" is prescribed for an adult, without any specification of quantities, the N. F. recommends that the above mixture be dispensed as one dose.

IODOFORMI COMPOSITUS (Iodoform and Naphthalin).—A mixture of Iodoform, 2 parts; Boric Acid, 3 parts; Naphthalin, 5 parts; with Oil of Bergamot, in fine powder.

This powder is used in many cases where a diluted preparation of Iodoform, for external purposes, is desired. The odor is masked both by the Oil of Bergamot and by the Naphthalin.

KINO COMPOSITUS.—A mixture of Kino and Cinnamon, with 1 grain (0.06) of Powdered Opium in each 20 grains (1.3).

MYRICÆ COMPOSITUS (Composition Powder).—A mixture of Bayberry, Ginger, Capsicum, and Cloves.

PANCREATICUS COMPOSITUS (Peptonizing Powder).—A mixture of 20 parts Pancreatin and 80 parts Sodium Bicarbonate; 25 grains will peptonize 1 pint of milk.

PEPSINI COMPOSITUS (Pulvis Digestivus).—A mixture of Pepsin, Pancreatin, Diastase, Lactic and Hydrochlone Acids, with Milk Sugar to represent the gastric juice.

Pulvis—

RHEI ET MAGNESIÆ ANISATUS (Compound Anise Powder).—

A mixture of Rhubarb, Heavy Magnesia, and Oil of Anise.

TALCI SALICYLICUS (Salicylated Powder of Talcum).—A mix-

ture of Talcum with 3 per cent. Salicylic Acid and 10 per cent. Boric Acid, in fine powder.

Powders are usually directed to be divided into papers (*chartulæ*); thus, for example, a formula for a prescription would be—

R̄. Hydrargyri Chloridi Mitis . . 1.

Sacchari Lactis 9.

Misce cum trituratione et in chartulis No. x. divide.

Encapsuling powders by filling them in gelatin capsules is a very convenient and elegant form of administration. No mixture which is desired to be given in the form of *powder*, however, should be made into a mass for facilitating the encapsuling process—a custom too frequently adopted. Many substances, especially Bismuth Subnitrate and Calomel, become exceedingly hard and quite insoluble when made into a mass. No dispenser should assume the prerogative of changing the form of medication prescribed.

SALÆ EFFERVESCENTES—EFFERVESCENT SALTS.

These are granulated mixtures of Salts with Sugar and Sodium Bicarbonate and Tartaric Acid, which effervesce when the Salt is dissolved in Water and furnish agreeable aerated draughts.

The following are official, the strength indicated being that contained in 60 grains (4 Gm.), a teaspoonful being the ordinary dose, dissolved in about 6 fluidounces (180 Cc.) of water:

	Gm	Gr.
Caffeina Citras Effervescens caffeine	0.16	2½
Lithii Citrata Effervescens lithium citrate	0.2	3
Magnesi Sulphas Effervescens magnesium sulphate (average dose 16 Gm. (240 grains), contains 8 Gm. (120 grains) mag. sulph.).		
Potassii Citras Effervescens potassium citrate	0.8	12
Sodii Phosphas Effervescens sodium phosphate	0.8	12

Effervescent Salts (Granular) N. F.

The strength given for these is the quantity contained in 90 grains (6 Gm.), which represents about the quantity of these Salts contained in a heaped teaspoonful of ordinary size, the average dose.

- FERRI ET QUININÆ CITRAS EFFERVESCENS**, 1 grain (0.06) Citrate of Iron and Quinine.
- FERRI PHOSPHAS EFFERVESCENS**, 2 grains (0.12) Phosphate of Iron
- POTASSII BROMIDUM EFFERVESCENS**, 20 grains (1.3) Potassium Bromide.
- POTASSII BROMIDUM CUM CAFFEINA**, 10 grains (0.6) Potassium Bromide and 1 grain (0.06) Caffeine.
- SAL CAROLINUS FACTITIUS EFFERVESCENS** (Effervescent Carlsbad Salt, artificial).—A solution of about 87 grains (5.5) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Carlsbad Water (Sprudel).
- SAL KISSINGENSIS FACTITIUS EFFERVESCENS** (Effervescent Kissingen Salt, artificial).—A solution of about 80 grains (5 Gm.) in 6 fluidounces (178 Cc.) represents an equal volume of Kissingen Water (Rakoczy).
- SAL VICHYANUS FACTITIUS EFFERVESCENS** (Effervescent Vichy Salt, artificial).—A solution of about 57 grains (4 Gm.) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Vichy Water (Grand Grille).

Salts (Non-effervescent).

- SAL CAROLINUS FACTITIUS**.—In two forms, Dry (Ph. Ger.) and Crystalline. A solution of about 16 grains (1 Gm.) of the Dry (27 grains (1.8) of the Crystalline) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Carlsbad Water (Sprudel).
- SAL KISSINGENSIS FACTITIUS**.—A solution of about 24 grains (1.5) in 6 fluidounces (178 Cc.) of Water represents an equal volume of Kissingen Water (Rakoczy).
- SAL VICHYANUS FACTITIUS**.—A solution of about 14 grains (1 Gm.) in 7 fluidounces (207 Cc.) of Water represents an equal volume of Vichy Water (Grand Grille).

CONFECTIONES—CONFECTIONS.

Confections may be defined as flavored masses wherein the adhesive substance is Sugar in large proportions, serving as a *vehicle* for masking the taste of the drug.

Confections, when made by beating a fresh drug, first reduced to pulp with sugar until of the proper consistence, are termed *conservees*. When made from powders or extracts they are called *electuaries*.

Only one representative of each class is official:

		Gm. in 100 Gs.
Confectio Rosæ	rose water 16, red rose	8.
(Conserve of Rose)	sugar 64, honey	12.
Confectio Sennæ	oil coriander 0.5, senna	10.
	cassia fistula 16, fig 12, tamarind	10.
	(Electuar. Sennæ) { prune 7, sugar 55.5, water to	100.

The Confection of Senna is a very agreeable laxative, especially adapted for constipation in women and children. It is exceedingly agreeable to the taste.

TROCHISCI—TROCHES.

Troches, or *lozenges*, are confections made into various forms and then dried.

The vehicle or excipient consists of Powdered Gum Tragacanth or Sugar with flavoring—in some cases orange flower water, in others tolu, nutmeg, vanilla, etc.

The active ingredients are mixed with the diluent or vehicle and made into a plastic mass with the particular excipient, Water or Syrup. The mass is rolled out to the requisite thickness, and the disks formed by cutting through it with a *punch* or troche-cutter. The troches are then dried by exposure.

The size and weight of the troche are regulated by the thickness of the mass and the diameter of the cutter.

The official Troches vary in weight from Gm. 0.5 to 1.5.

	ACTIVE DRUG.			
	Gm. in 100 Troches.	Gm. in each Troche.	Grains in each Troche.	
Trochisci—				
Acidi Tannici	6.	0.06	1	Orange flor.
Ammonii Chloridi	10.	0.1	1½	Tolu.
extract glycyrrhiza	20.	0.20	3½	
Cubebæ oleoresin	2.	0.02	½	
extract glycyrrhiza	25.	0.25	4	
sassafras oil	1.	0.01	½	
Gambir gambir	6.	0.06	1	Orange flor.
Glycyrrhizæ et Opii				
ext. glycyrrhiza	15.	0.15	2½	Anise.
powd. opium	0.5	0.005	⅛	
Krameriæ extract	6.	0.06	1	Orange flor.
Potassii Chloratis	15.	0.15	2½	
Santonini	3.	0.3	½	Orange flor.
Sodii Bicarbonatis	18.	0.18	3	Nutmeg.

Lozenges of Peppermint, Lemon, Musk, Vanilla, and Gaultheria may readily be prepared by saturating sugar lozenges with the respective essences or tinctures and permitting the alcohol to volatilize.

MASSÆ—MASSES.

Masses are plastic mixtures of *pilular* consistence. They are made by incorporating the drug with adhesive substances, by chemical reaction, and sometimes by both processes.

The Masses are intended to be formed into pills whenever they are to be dispensed. They are therefore often called *Pil.*, *Pilula*, instead of *Massa*. There are only two official:

Massa Ferri Carbonatis	{	sodium carb. 46, ferrous sulph., 100
(Vallet's Mass)	{	honey, 38, sugar 25, syrup to 100.

By double decomposition between the Ferrous Sulphate and Sodium Carbonate *ferrous carbonate* is formed, which is incorporated with Honey and Sugar to prevent oxidation and to render the mixture a plastic mass. The Pill of Ferrous Carbonate (*Pil Blaudii*) is preferable to this mass, as in the pill the ferrous carbonate is better protected against oxidation.

Massa Hydrargyri	{	glycyrrhiza 10, althæa 15, mercury 33.
(Blue Mass)	{	glycerin 9, honey of rose 33.

The mercury is extinguished by trituration with the rose honey and glycerin and the powdered glycyrrhiza; the other ingredients are then incorporated. The usual dose is from 5 to 10 grains (0.3-0.6).

PILULÆ—PILLS.

Pills are spherical, more or less soluble masses of medicinal substances rendered *cohesive*, *plastic*, and *firm* in consistence by the addition of some substance (usually inert) termed an *excipient*.

The *kind* of excipient employed varies with the nature of the medicinal substance. As a general rule, such substances are chosen as give to the mass, with the smallest proportion, the greatest plasticity, and also best preserve the spherical shape of the pills. The excipient must also, unless the contrary be directed for especial purposes, be indifferent in character, to avoid change in the medicinal agents.

Soluble substances are rendered adhesive by the action of sol-

vents, and require, according to their solubilities, the addition of some liquid such as Water, Alcohol, Glycerin, etc. Others require the addition of adhesive substances, such as Syrup, Mucilage, Glucose, Glycerite of Starch or Tragacanth, etc.

Drugs adapted for dispensing in the form of pills may be divided as follows:

(1) The official Masses, Extracts, and Scaled Salts.

Masses and extracts, being of pilular consistence, require no addition except when hard or dry; Water should then be incorporated to restore them to their original form. Powdered extracts are best made into a mass with Water.

(2) Vegetable Powders in which the dose does not exceed five grains.

With these *adhesive* excipients are indicated, such as Syrup, Mucilage, Glycerite of Tragacanth, and Glucose. The last mentioned answers the requirements better than most other substances. Confection of Rose and Extracts of Gentian, Glycyrrhiza, and Taraxacum are also used when their color is not objectionable.

(3) Salts not too deliquescent, and Alkaloids.

Excipients for these must combine *adhesive* and *absorbent* qualities. They are first triturated with a dry powder—*e. g.* Althæa, Glycyrrhiza, or Milk Sugar—and then mixed with the adhesive substance—*viz.* Glucose or Glycerite of Starch or Tragacanth.

No excipient must be used that will give to the mass a color different from that of the medicinal ingredients (the base).

(4) Volatile Oils and Oleoresins.

The quantity of these when dispensed in pills being comparatively large, it is necessary to add some light *absorbent* substance, such as Magnesia or Starch, to which is added the adhesive material. The practice of adding wax or resin to oils is not to be recommended except as a last resort, since they tend to render the pill insoluble.

(5) Resins and Gum Resins.

These form an adhesive mass by the addition of a little Alcohol, with which more bulky excipients, such as Soap, may be incorporated to preserve the shape of the pill.

(6) Salts of the Cinchona Alkaloids, Quinine and Cinchonidine Sulphates, etc.

These are often prescribed in pill form in large doses, and it is therefore desirable to reduce their bulk. For this purpose dilute Sulphuric Acid or Tartaric Acid is added in small quantity, which acts as a solvent upon the salt, thereby converting it into a mass.

In order to disguise the bitter or otherwise disagreeable taste of pills, they are usually coated with sugar or gelatin. These coated pills are often objectionable on account of the coating, or the pill itself, becoming quite insoluble. When a coated pill is desired, it should be freshly made and enclosed in a gelatin capsule of the smallest size. Pills may also be coated extemporaneously by rolling them on a piece of filter-paper saturated with Mucilage of Acacia, and then in powdered Milk Sugar.

Keratin-coated pills are designed for solution in the duodenum, the pills being dipped in a solution of Keratin prepared from horn shavings treated with pepsin and hydrochloric acid. Keratin is insoluble in the acid gastric juice.

Concentric pills are made up of concentric layers of different ingredients, intended to dissolve and become active at various stages in their passage through the intestinal tract.

Unofficial Pills of the National Formulary.

When a large number of pills are to be prepared in accordance with the given proportions, and the quantities of the ingredients are to be determined by multiplying with the number of pills required, it is recommended that the nearest whole number, or nearest convenient fraction, in each case, be chosen.

Pilule—

AD PRANDIUM (Dinner Pills).—When "Dinner Pills," under this or some other equivalent name, are prescribed without further specification, the National Formulary recommends that the *Pilulæ Aloes et Mastiches* of the U. S. P., also called "Lady Webster's Dinner Pills," be dispensed.

Of other combinations bearing similar names or used for similar purposes, the following appear to be those most commonly in use:

Chapman's Dinner Pill.—Aloes, Mastic, each, grains $1\frac{1}{2}$ (0.1); Ipecac, grain 1 (0.06); Oil of Fennel, grain $\frac{1}{2}$ (0.015).

Cole's Dinner Pill.—Aloes, Mass of Mercury, and Jalap, each, grains $1\frac{1}{2}$ (0.075), Ant. and Potas. Tartrate, grain $\frac{1}{8}$ (0.0013).

Hall's Dinner Pill.—Aloes, Ext. of Glycyrrhiza, Soap, and Molasses, each, grain 1 (0.06).

ALOES ET PODOPHYLLI COMPOSITÆ (Janeway's Pills).—Aloes, grain 1 (0.06); Resin Podophyllum, grain $\frac{1}{2}$ (0.03); Ext. Bellad. Alc., Ext. Nux Vomica, each, grain $\frac{1}{4}$ (0.015).

Pilule

ALOINI COMPOSITÆ.—Aloin, grain, $\frac{1}{2}$ (0.03); Resin Podophyllum, grain $\frac{1}{8}$ (0.01); Ext. Belladonna, grain $\frac{1}{4}$ (0.015).

ALOINI, STRYCHNINÆ ET BELLADONNÆ.—Aloin, grain $\frac{1}{2}$ (0.03 Gm.); Strychnine, alkaloid, grain $\frac{1}{100}$ (0.0005 Gm.); Alcoholic Extract of Belladonna, grain $\frac{1}{2}$ (0.008 Gm.).

ALOINI, STRYCHNINÆ ET BELLADONNÆ COMPOSITÆ.—Aloin, grain $\frac{1}{2}$ (0.012); Ext. Bellad. Alc., grain $\frac{1}{8}$ (0.008 Gm.); Strychnine, alkaloid, grain $\frac{1}{100}$ (0.0005); Ext. Rham. Pursh., grain $\frac{1}{2}$ (0.03).

ANTIDYSPEPTICÆ.—Strychnine, alkaloid, grain $\frac{1}{10}$ (0.0014); Ipecac, Ext. Bellad. Alc., each, grain $\frac{1}{10}$ (0.006); Mass of Mercury, Ext. Colocynth. Comp., each, grains 2 (0.13).

ANTINEURALGICÆ—1. *Gross' Antineuralgic Pills*: Quinine Sulphate, grains 2 (0.13); Morphine Sulphate, grain $\frac{1}{10}$ (0.003); Strychnine, alkaloid, grain $\frac{1}{100}$ (0.002); Arsenous Acid, grain $\frac{1}{10}$ (0.003); Ex. Aconite Leaves (U. S. P. 1870), grain $\frac{1}{2}$ (0.03).

When "Antineuralgic Pills," or "Neuralgia Pills," without other specifications, are prescribed, it is recommended that the above preparation be dispensed. Sometimes the Morphine is directed to be omitted.

2. *Brown-Séquard's Antineuralgic (or Neuralgia) Pills*: Extracts of Hyoscyamus and Conium, each, grain $\frac{1}{2}$ (0.04); Extracts of Ignatia and Opium, each, grain $\frac{1}{2}$ (0.03); Ext. Aconite Leaves, grain $\frac{1}{2}$ (0.02); Ext. Stramonium, grain $\frac{1}{2}$ (0.01); Ext. Indian Cannabis, grain $\frac{1}{2}$ (0.015); Ext. Bellad. Alc., grain $\frac{1}{2}$ (0.01).

ANTIPERIODICÆ (Warburg's Pills).—1. *With Aloes*: Aqueous Extract of Aloes, grain 1 (0.06); Rhubarb, grain $\frac{1}{2}$ (0.03); Elecampane, Saffron, Fennel, each, grain $\frac{1}{4}$ (0.015); Zedoary, Cubebs, Myrrh, White Agaric, Camphor, each, grain $\frac{1}{2}$ (0.008); Quinine Sulphate, grains 12 (0.085); Extract of Gentian, a sufficient quantity.

2. *Without Aloes*: The same formula as above, with omission of the Aqueous Extract of Aloes. These pills have been introduced for the purpose of facilitating the administration of Warburg's Tincture in a solid form. When "Warburg's Pills" or "Pills of Warburg's Tincture" are prescribed, without further specification, those containing Aloes are recommended to be dispensed—those without Aloes only when they are expressly demanded.

Pills—

Each Warburg's Pill represents about 1 fluidram (4 Cc.) of Warburg's Tincture. (See *Tinctura Antiperiodica*.)
COLOCYNTHIDIS COMPOSITÆ (Pilulæ Cochia).—Extract of Colocynth, grain $\frac{1}{2}$ (0.01); Aloes, Resin of Scammony, of each, grains 2 (0.13); Oil of Cloves, min. $\frac{1}{4}$ (0.015).

COLOCYNTHIDIS ET HYOSCYAMI.—Extract of Colocynth, grain $\frac{1}{10}$ (0.006); Aloes, Resin of Scammony, Ext. Hyoscyamus, each, grains $1\frac{1}{2}$ (0.1); Oil of Cloves, min. $\frac{1}{8}$ (0.01).

COLOCYNTHIDIS ET PODOPHYLLI.—Compound Extract of Colocynth, grains $1\frac{1}{2}$ (0.16); Resin of Podophyllum, grain $\frac{1}{2}$ (0.015).

FERRI COMPOSITÆ (U. S. P. 1880).—Myrrh, $1\frac{1}{2}$ grains (0.1); Ferrous Sulphate, Sodium Carbonate, each, $\frac{3}{4}$ grains (0.048).

GALBANI COMPOSITÆ (U. S. P. 1880).—Galbanum, Myrrh, each, $1\frac{1}{2}$ grains (0.1); Asafœtida, $\frac{1}{2}$ grain (0.03).

GLONOI (Nitroglycerin).—Spirit of Glonoin (1 per cent.), Athæa, each, grains 200 (13.0); Confection of Rose, a sufficient quantity. Make a mass and divide it into two hundred (200) pills. Each pill contains $\frac{1}{100}$ grain (0.0007) of Glonoin (Nitro-glycerin).

LAXATIVÆ POST-PARTUM (Barker's).—Ext. Colocynth. Comp., grains $1\frac{1}{2}$ (0.1); Aloes, grain $\frac{1}{2}$ (0.05); Res. Podoph., Ipecac., each, $\frac{1}{12}$ grain (0.005); Ext. Nux Vomica, $\frac{1}{12}$ grain (0.03); Ext. Hyoscyamus, $1\frac{1}{2}$ grains (0.8).

This is the formula generally employed by Dr. Fordyce Barker, except where special circumstances render modifications necessary. The formula usually quoted in manufacturers' lists and some formularies is not correct.

METALLORUM (Metallorum Amaræ).—Reduced Iron and Quinine Sulphate, each, grain 1 (0.06); Strychnine and Arsenous Acid, of each, grain $\frac{1}{16}$ (0.003).

Aitken's Tonic Pill is a similar combination:

Reduced Iron, grain $\frac{3}{4}$ (0.04); Quinine Sulphate, grain 1 (0.06); Strychnine, Arsenous Acid, each, grain $\frac{1}{16}$ (0.0012).

OPII ET CAMPHORÆ.—Powdered Opium, 1 grain (0.06); Camphor, grains 2 (0.13).

OPII ET PLUMBI.—Powdered Opium and Acetate of Lead, each, grain 1 (0.06).

PODOPHYLLI, BELLADONNÆ ET CAPSICI (Squibb's Podophyllum Pills).—Resin Podophyllum, grain $\frac{1}{2}$ (0.015), Capsicum,

Pilulae—

grain $\frac{1}{2}$ (0.03); Ext. Bellad. Alc., grain $\frac{1}{8}$ (0.008); Sugar of Milk, grain 1 (0.06); Acacia, Glycerin, and Syrup, each, a sufficient quantity.

QUADRUPLICES (Ferri et Quininae Compositae).—Ferrous Sulphate, Quinine Sulphate, Aloes, each, grain 1 (0.06); Ext. Nux Vomica, grain $\frac{1}{2}$ (0.015); Ext. Gentian, sufficient.

TRIPLICES (Triplex).—Aloes, grains 2 (0.13); Resin Podophyllum, grain $\frac{1}{2}$ (0.015); Mass of Mercury, grain 1 (0.06).

When *Pilula Triplex*, under this name or some equivalent, is prescribed without further specification, the N. F. recommends that the above preparation be dispensed. A formula devised by John W. Francis is also in use:

2. *Francis's Triplex Pill*.—Aloes, Scammony, Mass of Mercury, of each, grain $\frac{1}{2}$ (0.05); Croton Oil, $\frac{1}{8}$ min. (0.003); Oil of Caraway, grain $\frac{1}{2}$ (0.015); Tincture of Aloes and Myrrh, a sufficient quantity.

UNOFFICIAL FORMS OF MIXTURES OF SOLIDS FOR INTERNAL USE.

Granules are small pills, less than 1 grain (0.06) in weight, usually sugar-coated and containing alkaloids and other active drugs.

Parvules are identical with granules. They are usually colored red or pink.

Globules (*Orbiculæ*) are sugar pellets to be saturated with alcoholic solutions of medicinal agents, chiefly in Homœopathy.

Compressed Pills or *Tablets* are made by compressing powders into disks not exceeding 10 grains (0.7) in weight, without any excipient.

Friable Pills are made by aggregation, spreading the powdered mixture upon nuclei or sugar granules in a revolving pan until the pills are formed.

Bolus is the name given to pills exceeding 5–10 grains (0.3–0.6) in weight, used in veterinary practice. A sugar-coated bolus is called a *Dragee*.

Rotulae are disk-shaped forms of sugar about $1\frac{1}{2}$ grains (0.1) in weight, which may be flavored with alcoholic solution (spints).

Bacilli are cylindrical sticks, a form of lozenge (*Licorice*).

Lamellæ, thin squares of gelatin in which the active agent has been incorporated, intended for solution in the eye.

PREPARATIONS FOR EXTERNAL USE.

To this group belong the *liquid* preparations: Liniments, Oleates and Collodions, and the mixtures of *solids*: Ointments, Cerates, Suppositories, Plasters, and Papers. The Vehicle, sometimes incorrectly called the "base," consists chiefly of fatty substances which serve as protectives or facilitate absorption. The Collodions are, however, an exception.

The solid mixtures may be classified according to their *fusibility*, or melting-points, because their therapeutic uses, as well as their pharmaceutical forms, are through this quality respectively determined.

Ointments fuse at the body-temperature, and therefore produce an emollient effect, or induce *absorption* of the medicinal substance by the system. They are applied by rubbing or inunction.

Cerates have a higher fusing-point, due to Wax they contain; the medicinal agent is not so readily absorbed, and they are therefore used to produce *local* effects, being spread on cloth and applied as *dressings*.

Suppositories fuse slowly when introduced into a body cavity, but maintain their shape at ordinary temperatures. They are for use in rectum, urethra, or vagina.

Plasters have a still higher fusibility; they do not melt, but become *adhesive* by the body-temperature, and are intended to produce *local* effects and afford *mechanical support* to the parts affected.

The fusibilities of these various preparations are likewise governed by the respective vehicles employed.

LINIMENTA—LINIMENTS.

The Liniments are liquid preparations for external use, consisting of solutions of *oily* or *resinous* constituents in Alcohol or Oils, or mixtures of liquid Soaps. The official Liniments are prepared by simple admixture or solution.

Linimentum—

Ammonia	cottonseed oil 57; oleic acid 3; ammonia water 35; alcohol 5.
Belladonna	. . .	camphor 5 Gm.; fl. ext. belladonna to make 100 Cc.
Calcis (Carron Oil)	linseed oil 50; lime water 50.
Camphor	cottonseed oil 80 Gm.; camphor 20 Gm.
Chloroformi	. . .	soap liniment 70 Cc.; chloroform 30 Cc.

Linimentum—

- Saponis** camphor 4.5 soap 6;
 rosemary oil 1; alcohol 72.5; water to make 100 Cc.
Saponis Mollis lavender oil 2; soft soap 65 Gm.;
 alcohol to make 100 Cc.
Terebinthinæ . . resin cerate 65 Gm.; turpentine oil 35 Gm.

*Unofficial Liniments of the National Formulary.***Linimentum—**

- ACONITI ET CHLOROFORMI.**—Tincture of Aconite, Chloroform, each, 2 fluidounces (60 Cc.); Soap Liniment, 12 fluidounces (355 Cc.).
- AMMONII IODIDI.**—Iodine, 30 grains (2.); Oil of Rosemary, Oil of Lavender, each, 110 minims (7 Cc.); Camphor, 220 grains (15.); Water of Ammonia, 1½ fluidounces (50 Cc.); Alcohol, enough to make 16 fluidounces (473.17 Cc.). On standing, it becomes colorless.
- CANTHARIDIS** (U. S. P. 1880).—Oil of Turpentine containing 15 per cent. of Cantharides.
- IODI** (similar to Ph. Br.).—Iodine, 900 grains (60.); Potassium Iodide, 360 grains (24.); Glycerin, ½ fluidounce (15 Cc.); Water, 1 fluidounce (30 Cc.); Alcohol, enough to make 16 fluidounces (473.17 Cc.).
- OPII COMPOSITUM** (Canada Liniment).—Tincture of Opium, 1½ fluidounces (45 Cc.); Camphor, 120 grains (8.); Alcohol, 4 fluidounces (118 Cc.); Oil of Peppermint, 180 minims (12 Cc.); Water of Ammonia, 6 fluidounces (180 Cc.); Oil of Turpentine, enough to make 16 fluidounces (473.17 Cc.).
- PLUMBI SUBACETATIS** (U. S. P. 1880).—Solution of Lead Subacetate, 35 parts; Cotton Seed Oil, 65 parts.
- SAPONATO-CAMPHORATUM** (Opodeldoc; Solid Opodeldoc).—White Castile Soap, 1½ ounces (45.); Camphor, ½ ounce (15.); Alcohol, 20 fluidounces (592 Cc.); Oil of Thyme, 30 minims (2 Cc.); Oil of Rosemary, 60 minims (4 Cc.); Water of Ammonia, Fort., 1 fluidounce (30 Cc.).
- TEREBINTHINÆ ACETICUM** (Linimentum Album, Stokes' Liniment; St John Long's Liniment).—Oil of Turpentine, 3 fluidounces (89 Cc.); Fresh Egg, 1; Oil of Lemon, 60 minims (4 Cc.); Acetic Acid, 300 minims (20 Cc.); Rose Water, 2½ fluidounces (75 Cc.).
- TIGLI** (Linimentum Crotonis, Ph. Br.).—Croton Oil, 2 fluidrams (8 Cc.); Oil of Cajuput, 7 fluidrams (27.5 Cc.).

Mistura—

TIGLI COMPOSITUM.—Croton Oil, 1 fluidounce (30 Cc.); Oil of Sassafras, 1 fluidounce (30 Cc.); Oil of Turpentine, 1 fluidounce (30 Cc.); Oil of Olive, 2 fluidounces (60 Cc.).

LOTIONES—WASHES.**Loto—**

ADSTRINGENS (Warren's Styptic).—A mixture of Sulphuric Acid, Oil of Turpentine, and Alcohol.

FLAVA (Yellow Wash, Aqua Phagedænica Flava, Ph. Ger.).
—Corrosive Mercuric Chloride, 24 grains (1.5), in Lime Water, 16 fluidounces (473 Cc.).

NIGRA (Black Wash; Aqua Phagedænica Nigra, Ph. Ger.).
—Mild Mercurous Chloride, 64 grains (4.), in Lime Water, 16 fluidounces (473 Cc.).

PLUMBI ET OPII (Lead-and-Opium Wash).—Lead Acetate, 120 grains (8.); Tincture of Opium, $\frac{1}{2}$ fluidounce (15 Cc.); in Water, 16 fluidounces (473 Cc.) To be shaken when dispensed.

The following are unofficial solutions and mixtures for external use:

Injectio, -ones.—Aqueous solutions for introduction by means of a syringe in the orifices of the body.

Injectio Hypodermica.—Solution for hypodermic or subcutaneous injection.

Enema, -atis; Clyster.—A warm solution of Soap or a mucilaginous mixture for injection in the rectum to produce evacuation, or for nutrition.

Gargarisma, -atis; Gargle.—A wash or lotion for the throat.

Collyrium, -i; "Eye-wash."—A weak solution for instillation in the eyes.

Nebula, -æ; Spray.—A liquid intended for application by means of an atomizer.

Vapor, -oris; Inhalation.—Volatile agents to be added to boiling water and inhaled, to affect the air-passages.

Balneum, -et; Bath.—Mixture to be added to water for bathing purposes.

OLEATA—OLEATES.

The official Oleates are solutions of oleates in Oleic Acid. They are distinct from the solid oleates, which are made by double decomposition of salts of the metals and alkaline earths and sodium oleate, or Soap. (See Soap.)

The *liquid* or *official* Oleates are intended for endermic medication. They are applied by inunction, when the Oleic Acid favors the absorption of the medicinal agent, the oleate in solution. When it is not desirable to administer remedies by the mouth, the Oleates afford an effective form of medication.

The *solid* Oleates are either dry powders, well adapted for protectives as dusting powders, or soft, pliable masses to be applied in the form of ointments or plasters.

Oleatum—

		<i>Percentage by Weight.</i>
ATROPINÆ	atropine	2
COCAINÆ	cocaine	5
HYDRARGYRI	yellow mercuric oxide	25.
QUININÆ	quinine	25.
VERATRINÆ	veratrine	2

Unofficial Oleates of the National Formulary.

The following are simply solutions of the alkaloids in Oleic Acid:

ACONITINÆ.—Contains 2 per cent. of crystallized Aconitine (Duquesnel's).

QUININÆ.—Contains 25 per cent. of Quinine (Alkaloid).

Of the solid Oleates introduced by Dr. J. V. Shoemaker, the following have been recognized, but others may also be prepared as desired:

OLEATUM PLUMBI.—Contains about 28 per cent. of Lead Oxide.

It is of the consistence and general character of Lead Plaster, and suggests similar use.

OLEATUM ZINCI.—In the form of a soft white powder, useful as a "dusting powder," or converted into a plaster or ointment by mixing it with such proportion of Oleic Acid as may be required.

OLEA INFUSA—INFUSED OILS.

These preparations are obtained by infusing a dry herb, usually from the so-called narcotic plants, in five times its weight of a mixture of equal parts of Cotton Seed Oil and Lard Oil. *Oleum*

Hyoscyami Infusum is the most familiar example. There are none official.

Oleum—

CARBO LATUM.—A mixture of Cotton Seed Oil with 5 per cent. of Carbolic Acid.

HYOSCYAMI COMPOSITUM (*Balsamum Tranquillans*).—Infused Oil of *Hyoscyamus*, with a small proportion of each of the Ethereal Oils of Absinth, Lavender, Rose, Sage, and Thyme.

COLLODIA—COLLODIONS.

The Collodions are solutions in Ether-Alcohol of Pyroxylin or Soluble Gun Cotton. Upon evaporation of the solvent the remaining film excludes the air, thus protecting abraded surfaces. Collodion is also used as a vehicle when a prolonged local effect is desired.

The following forms are official :

	<i>Per cent</i>
Collodium . . . solution in ether 75 ; alco. 25 ; pyroxylin	4
Collodium Flexile . . . castor oil 3 ; Canada turpentine	5
Collodium Stypticum . . . alco. 5 ; ether 25 ; acid tan.	20
Collodium Cantharidatum (<i>Blistening Collodion</i>) . (flex. collo.) cantharides	60

Unofficial Collodions.

Collodium—

IODATUM (*Iodized Collodion*).—Contains 5 per cent. Iodine in Flexible Collodion.

IODOFORMATUM (*Iodoform Collodion*).—Contains 5 per cent. Iodoform in Flexible Collodion.

SALICYLATUM COMPOSITUM (*Corn Collodion*).—Contains 11 per cent. Salicylic Acid and 2 per cent. Ext. *Cannabis Indica* in Flexible Collodion.

TIGLII (*Croton Oil Collodion*).—Contains 10 per cent. Croton Oil in Flexible Collodion.

UNGUENTA—OINTMENTS.

Ointments are mixtures of a fatty vehicle with which medicinal agents are incorporated, readily fusing at the body-temperature, 35° to 40° C. (95° to 104° F.).

The medicinal ingredients must be minutely distributed through the vehicle in order that the ointment may not prove irritating, and that the greatest possible surface be presented to the epidermis

with a view to quick and uniform absorption. For this reason the highest quality of an ointment (next to its proper melting-point) is *smoothness*. In the preparation of ointments care must therefore be taken that the method employed be such as to yield *smooth* products.

The melting-point is governed by the fusibility of the vehicle used, which is either officially directed, as in official preparations, or in extemporaneous preparations prescribed by the physician.

The official Ointments are prepared (1) by mechanical admixture, (2) by fusion, or (3) by chemical reaction.

Mixing the medicinal substances with the fatty body in a mortar or on a slab is the process usually employed for solid substances, especially when insoluble in the fat. Powdered drugs, acids, alkaloids, extracts, and salts (not attended by chemical union) are examples adapted to this process.

The following points must be observed :

Solids must be in a fine powder before being incorporated with the vehicle ; sometimes it is an advantage to triturate the solid with a small quantity of a bland fixed oil, as Almond Oil or Olive Oil, into a smooth cream before it is mixed with the vehicle proper—Lard, etc.

Extracts should be reduced to a semi-liquid condition by trituration with a little dilute Alcohol or Water. Substances soluble in fats, such as Carbolic Acid, Iodine, and Camphor, may be dissolved directly in the fat by the aid of a gentle heat.

The following are the official Ointments, with their drug-strengths, their respective vehicles being given in parentheses :

Unguentum—		Percentage of Drugs.
Acidi Borici	(paraffin and white petrolatum)	10
Acidi Tannici	(glycerin and oint.)	20
Aquæ Rosæ (Cold Cream) . .	spermaceti 12.5 ; white wax 12 ; expressed oil of almond	56
	then incorporate borax 0.5 ; rose water	19
Belladonnæ extract	(dil. alcohol 5 ; benz. lard and hydrous wool-fat)	10
Chrysarobini (chrysophanic acid)	(benz. lard)	6
Diachylon (Hebra's)	lead plaster	50
	oil lavender 1 ; olive oil	49
Gallæ	(ointment)	20
Hydrargyri (Mercurial Ointment)	mercury	50
	mercuric oleate 2 ; suet 23 ; benz. lard	25

Unguentum—

Hydrargyri Ammoniaci . . .	(white petrolatum and hydrous wool-fat)	10
Hydrargyri Dilutum (Blue Ointment) .	mercurial oint.	67
	petrolatum	33
Hydrargyri Nitratis (Citrine Ointment) . . .	mercury	7
	nitric acid 17.5 ; lard	76
Hydrargyri Oxidi Flavi . . .	(hydrous wool-fat and petrolatum)	10
Hydrargyri Oxidi Rubri . . .	(hydrous wool-fat and petrolatum)	10
Iodi (potass. iod. 4, glycerin benz. lard) . . .	iodine	4
Iodoformi	(lard)	10
Phenolis	(white petrolatum)	3
Picis Liquidæ	yellow wax 15 ; lard 35 ; tar	50
Potassii Iodidi . (pot. carb. 0.6 ; water 10 ; benz. lard)		10
Stramonii Extract . . . (dil. alc. 5 ; hydrous wool-fat		
	and benz. lard)	10
Sulphuris (washed)	(benz. lard)	15
Veratrinæ (almond oil 6)	(benz. lard)	4
Zinci Oxidi	(benz. lard)	20
Zinci Stearatis	(white petrolatum)	50

Unofficial Ointments of the National Formulary.

UNGUENTUM ACIDI GALlici (U. S. P. 1880).—Contains 10 per cent. Gallic Acid.

UNGUENTUM CALAMINÆ (Unguentum Zinci Carbonatis Impuri; Turner's Cerate).—Contains 17 per cent. Zinc Carbonate (Imp.).

UNGUENTUM CAMPHORÆ (Unguentum Camphoratum).—Contains 20 per cent. Camphor.

UNGUENTUM FUSCUM (Unguentum Matris; Mother's Salve).—Contains 50 per cent. of Camphorated Brown Plaster (N. F.).

UNGUENTUM MEZERII (U. S. P. 1880).—Represents 25 per cent. Mezerium.

UNGUENTUM PICIS COMPOSITUM (Tar, Comp.).—Contains Oil of Tar, 4 per cent.; Tincture of Benzoin, 2 per cent.; and Oxide of Zinc, 3 per cent.

UNGUENTUM SULPHURIS ALKALINUM (U. S. P. 1880).—Contains 20 per cent. Sulphur and 10 per cent. Potassium Carbonate.

UNGUENTUM SULPHURIS COMPOSITUM (Wilkinson's Ointment; Hebra's Itch Ointment).—Precipitated Calcium Carbonate, 10; Sublimed Sulphur, Oil of Cade, of each, 15; Soft Soap and Lard, of each, 30 parts. The Lard is mixed with the Soft Soap and Oil of Cade; the Sublimated Sulphur and Precipitated Calcium Carbonate are then gradually incorporated.

CERATA—CERATES.

Cerates are mixtures of fats similar to the ointments, but of firmer consistence, because they contain Wax, Resin, or Paraffin (having a higher melting-point than Lard) in greater proportion than do ointments. In the preparation of Cerates the same rules are to be observed as noted under Ointments.

The six official Cerates are prepared by fusion or simple admixture, and one by extraction and digestion (Ceratum Cantharidis):

		<i>Percentage of Drugs.</i>
CERATUM (Simple)	white petrolatum 20; benz. lard	50
	white wax	30
Camphoræ	camphor liniment 10; white petrolatum	15
	benz. lard 40; white wax	35
Cantharidis (Blistering Cerate)	liquid petrolat 15; lard	17
	cantharides	32
	yellow wax, resin, each	18
Plumbi Subacetatis (Goulard's Cerate)	camphor	2
	solution lead subacetate	20
	wool-fat; paraffin; white petrolat.	
Resinæ (Basilicon)	yellow wax 15; lard 50; rosin	35
	in cold weather yellow wax 12;	
	lard 53; resin	35
Resinæ Compositum	rosin 22.5; yellow wax 22.5;	
	suet 30; turpentine 11.5; linseed oil	13.5

CERATUM CAMPHORÆ COMPOSITUM, N. F. (Camphor Ice).—Moulded into small cakes suitable for popular use as an application to excoriated surfaces. It contains very small quantities of Benzoic and Carbolic Acids.

SUPPOSITORIA—SUPPOSITORIES.

Suppositories may be defined as variously shaped masses of medicated fat, possessing a consistence ensuring their quick fusion when introduced in the orifices of the body.

The U. S. P. defines Suppositories with reference to their *weights* and *shapes*, corresponding to their several uses—*i. e.* for introduction in the respective orifices of the body—as follows:

Rectal, cone-shaped or spindle-shaped, should weigh 30 grains (2 Gm.).

Urethral, pencil-shaped, should weigh 30 to 60 grains (2-4 Gm.).

Vaginal, globular or oviform, should weigh about 60 grains (4 Gm.).

The vehicle is Cacao Butter (*Oleum Theobromatis*) or Glycerinated Gelatin, both of which possess the property of melting at the temperature of the human body, 35°C. (95°F.), and yet remaining firm at ordinary temperatures. An addition of 10 to 15 per cent. of spermaceti is recommended to raise the melting-point and thus give more stability to suppositories during the heated seasons of the year, or if they contain chloral, phenol, or other substances which soften the vehicle.

The U. S. P. gives a general formula for preparing suppositories; only one Suppository is official, and this is not made from Cacao Butter.

The *methods* of preparing suppositories are quite numerous: any process may be employed by which the product is obtained uniform in size and shape and with the medicinal ingredients thoroughly incorporated. Moulds are usually employed; the medicinal ingredients, if solid, are first reduced to powder in a mortar, and mixed with a small quantity of the grated Fat; the remainder of the Fat, previously melted and cooled to 35°C. , is then gradually incorporated with this mixture, thoroughly mixed, and, if possible, without further heating, poured into the moulds, previously chilled.

Another process consists in rolling the mass on a slab, cutting it as in making pills, and forming the cones with the fingers. By cold compression in a screw-press "machine," suppositories may be formed from the prepared mass.

Urethral Suppositories are commonly called *Bougies*, or, more properly, Medicated Bougies. They are usually made with the addition of Wax, or from Glyco-gelatin mass.

Suppositoria Glycerini.—Glycerin 30, sodium carbonate 0.5;

stearic acid 2; water 5. They are made by heating until a solution of *sodium stearate*, or soap, is formed, which is poured into a mould. Upon cooling, the mixture gelatinizes and the suppository is wrapped in tin-foil.

Uses.—Upon introduction into the rectum the mass melts, and the Glycerin, acting upon the feces, produces evacuation.

A formula for suppositories would be:

Extracti Belladonnæ Fol., alc., 0.1;
 Acidi Tannici, 1.0;
 Olei Theobromatis, q. s. (20 Gm.).
 Fiant suppositoriæ No. x. (2 Gm.).

Each suppository would contain $\frac{1}{2}$ grain (0.01) Ext. Belladonna and $1\frac{1}{2}$ grains (0.1) Tannic Acid.

EMPLASTRA.—PLASTERS.

Plasters are mixtures of various fatty or resinous solids of such high melting-point as to be friable when cold, but rendered *adhesive* by the warmth of the body.

The *vehicles* of plasters are: Lead plaster; resinous substances, made adhesive by admixture with the medicinal ingredients; and simple plasters, such as isinglass.

The *making* of plasters does not differ materially from the process employed for ointments and cerates, since they are all prepared by melting the various substances and incorporating the medicinal substances last. The *spreading* of plasters, though usually done on a large scale, may be easily effected by the pharmacist with the use of a plaster iron.

The official Plasters may be divided into: (1) Lead Plasters; (2) Pitch and Gum-Resin Plasters; and (3) Isinglass Plasters.

(1) The most important plasters are made from Lead Plaster, or Lead Plaster mixed with Resin, the official Resin Plaster.

Emplastrum—

*Percentage or
parts in 100.*

Adhæsivum . . rubber 2; petrolatum 2; lead plaster 96
 Plumbi (Diachylon) . . . soap 100; lead acetate 60;
 water q. s.

From these the following are prepared:

Emplastrum—

Belladonnæ	ext. belladonna leaves	30
	adhesive plaster	70
Capsici	adhesive plaster, 15x15 cm.;	
	oleoresin capsicum	0.25
Hydrargyri	hydrous wool-fat	10; lead plaster 50;
	mercury oleate	1; mercury 30
Opii	adhesive plaster	90; water; ext. opium 6
Saponis	lead plaster	90; soap 10

*Unofficial Plasters of the National Formulary.***Emplastrum—**

AMMONIACI (U. S. P. 1880).—Gum-resin Ammoniac with Acetic Acid.

AROMATICUM (Spice Plaster).—Consisting of Cloves, Cinnamon, and Ginger, each, 10 per cent.; Capsicum and Camphor, each, 5 per cent.

ASAFETIDÆ (U. S. P. 1880).—Asafoetida 35 p.; Galbanum 15 p.; with Lead Plaster.

FUSCUM CAMPHORATUM (Matris Camphoratum, Ph. Ger.).—Camphorated Mother's Plaster. A plaster similar to lead plaster, and containing camphor, 1 per cent.

GALBANI (U. S. P. 1880).—Galbanum Plaster.

PICIS CANADENSIS (U. S. P. 1880).—Canada Pitch Plaster.

PICIS LIQUIDÆ COMP.—A mixture of Resin and Tar, with Podophyllum, Phytolacca, and Sanguinaria, of each, 10 per cent.

CHARTÆ—PAPERS.

There is one Paper official. It is paper coated with Mustard, used similarly to the Plasters:

Charta Sinapis . . . oil-free black mustard, 4 Gm. in 60 sq. cm.

The Mustard is freed from the fixed oil by extraction with Benzine, and mixed with a solution of India Rubber in equal volumes of Benzine and Carbon Disulphide, and spread upon Paper. This is the well-known Mustard Plaster or Mustard Paper. When applied, the paper should be immersed in lukewarm water for a few minutes, in order to render the vesicating principle active.

CHARTA CANTHARIDIS, U. S. P. 1880.—Cantharidis Paper (Blistering Paper).

Poultice or Cataplasma (Lat. *Cataplasma*, -atis).—A coarsely ground substance or mixture of substances, such as flaxseed or elm-bark, made into a mass with hot water or some other liquid, spread upon cloth or filled into porous bags, and applied to the body while hot.

Fomentations (Lat. *Fomentum*, -i).—Porous woollen cloths saturated with hot infusion or decoction of herbs, or other hot liquids or lotions, and applied hot.

Spongiopiline.—A thick cloth covered with layers of sponge for the saturation and retention of medicinal agents intended for absorption, the exterior being composed of waterproof material, such as rubber.

Plaster-Mull.—A thin cloth made impervious with rubber or gutta-percha tissue, upon which is spread or painted medicinal agents in the liquid form, intended for local application.

Caustics or Escharotics (Gr. *Escharotikos*)—Substances used to destroy tissue by chemical action or by heat, either semi-solid mixtures made into a *paste* with starch or other diluent, or chemicals fused and moulded into sticks called *pencils* or "crayons" (Lat. *stilus*, -i), to be applied directly to the skin. *Moxa* is the name given to small cones of combustible substances which upon incineration do not inflame, but give off an intense heat, used for cauterization when heat is desired.

Bandages; Antiseptic Dressings.—The material used for bandages is cellulose in various modifications, such as cotton, linen, jute, and other fibrous substances. Aside from the mechanical support afforded, bandages also serve to keep wounds clean by absorbing and withdrawing secretions (pus) which would otherwise prove irritating, and by protecting them against extraneous matter serve to promote the healing process.

These various substances may be used either plain or medicated, when they are called *antiseptic*.

Gossypium Purificatum, U. S. P.; Absorbent Cotton.—The hairs of the seed of *Gossypium herbaceum* L., freed from oil and resinous substances by treatment with alkalies and bleaching agents. These hairs represent microscopic ducts in which liquids are absorbed through capillarity. The freer from oily constituents, the more readily will watery liquids be taken up and retained; hence, the absorbability of cotton depends upon its purity. This is equally true with all other bandage material.

Linen in the form of thin sheets, known as *Muslin* or *Muslin*-

gauze, or purified similarly to cotton, when it is called *Lint*, is made from the bast-fibres of the *Linum usitatissimum* L., Flax. Hemp and Jute are the bast-fibres of their respective plants.

Medicated Dressings.—These are made by saturating the material or vehicle in a solution of certain strength of the medicinal agent, or incorporating the latter in powdered form. In the application of a dressing which has been rendered aseptic or antiseptic by impregnating it with Phenol (Carbolic Acid), Salicylic Acid, Mercuric Chloride, or similar agent, it is desired to bring in contact with the wound a solution of certain strength—for example, a 5 or 10 per cent. solution of Phenol, a $\frac{1}{10}$ or $\frac{1}{20}$ of 1 per cent. solution of Mercuric Chloride, etc. The quantity of material which conveys the agent is of no consequence, as the fabric simply serves as a vehicle for the medicinal or antiseptic agent. The strengths of such dressings should therefore be designated by the *percentage-strength of the solutions by which they are saturated*, rather than by the percentage by weight of the medicinal agent the finished dressing may contain.

In dressings of antiseptic agents that are usually applied in substance, such as Boric Acid and Iodoform, the percentage-amount actually contained by weight in the finished dressing should be stated. Here the use of a vehicle is only a matter of convenience, and it is desirable to know just how much of the medicinal agent is contained in a certain quantity by weight or by area of the dressing.

Medicated Cottons.—Purified cotton is saturated in a solution in Water, or Glycerin and Water, of the strength desired of the medicinal agent, and thoroughly expressed.

The following are the usual strengths:

	<i>Percentage.</i>
Gossypium Boratum acid boric	5 or 10
Carbolatum phenol	5 or 10
Iodoformatum iodoform	10 to 20
Salicylatum acid salicylic	10 to 20
Stypticum Monsel's solution	
Sublimatum mercuric chloride	$\frac{1}{10}$ to $\frac{1}{20}$

Iodoform, being insoluble in Water, should be dissolved in Ether or, preferably, in a mixture of Alcohol and Glycerin.

Medicated Gauzes; Carbasa.—The material used for making Medicated Gauzes is a muslin gauze free from sizing or other extraneous matter. The gauze is thoroughly impregnated with the

solution of the particular strength required, then forcibly expressed, after which it is ready for use; or, if desired for future use, it should be tightly rolled, wrapped in parchment paper, and kept in closely covered boxes in a cool, dry place.

The following are the most commonly used Gauzes and their strengths:

	<i>Percentage.</i>
Carbasus Boratum	acid boric 5-10
Carbolatum	phenol 5-10
Iodoformatum	iodoform 10-20
Salicylatum	acid salicylic 10-20
Sublimatum	mercuric chloride $\frac{1}{10}$ - $\frac{1}{15}$

The Iodoform Gauze is made in the same way as the Cotton, by saturation with a solution of Iodoform in Alcohol and Glycerin. All the others, except the Mercurial Gauze, contain Glycerin. Mercuric Chloride is dissolved in Water with a little Acid Tartaric (5 parts for 1 of Mercuric Chloride), the presence of which in the Gauze prevents the formation of insoluble albuminate of mercury when it is brought in contact with the albuminous discharges from wounds.

Plaster-of-Paris bandages are made by thoroughly incorporating Calcium Sulphate (gypsum) into linen bandages. When applied, the bandage, after being dipped in water, sets hard and firm in a few minutes.

DRUGS WHOSE CHIEF ACTION IS ON THE NERVOUS SYSTEM.

THE ALCOHOLS

[In the present work care has been taken to designate the proper pronunciation of the names of drugs and their preparations common to *Materia Medica* and *Therapeutics*. The simplest and most efficient method appears to be that herein followed—namely, to indicate accent and quantity by a single sign, for example: Alcohol (nom.) —Alc·hoh·lis (gen.), in which the A is short in the nominative and the accent upon the first syllable, while in the genitive the o is short and the accent is long upon the third syllable.

In nearly all cases the *genitive*, as used in prescription-writing, and the *English equivalent*, are given. When the *accusative*, not genitive, is adopted, the usage is marked by "acc.", as, *Pilulae*, *Pilulas* (acc.), etc.]

A LARGE number of compounds which are derived from members of the marsh-gas series are employed in medicine as depressants of the nervous system, acting more particularly on the higher cortical structures. They are here considered in one general group because of their close similarity in pharmacological action and in therapeutic efficiency. While the fundamental action of these derivatives is on nervous structures, it not infrequently happens that other effects—such as the action of alcohol on the heart, of chloral on muscular tissues, etc.—are of great therapeutic service. Such a consideration brings again into prominence the difficulties of therapeutic classification.

The bodies here under discussion are very numerous. They are derived from various members of the series, and include hydrocarbons, alcohols, ethers, aldehydes, ketones, esters, acids, halogen substitution compounds and their derivatives.

The simplest members of the paraffine group of this series are pentane, C_5H_{12} , hexane, C_6H_{14} , both of which are distilled from petroleum, coming off between 62° – 80° C. (144° – 176° F.). Their mixture constitutes the well known PETROLEUM NAPHTHA, or naphtha, used so extensively in some anesthetic mixtures; GASOLIN, or benzine, coming off at higher temperature, 80° – 120° C. (176° – 248° F.), containing heptanes, C_7H_{16} ; octanes, C_8H_{18} , has also been used as a general anesthetic.

Of the olefines, or unsaturated hydrocarbons, AMYLENE, C_5H_{10} , and ACETYLENE, C_2H_2 , have been used as general anesthetics. They have not proved satisfactory.

The hydroxyl compounds of the saturated hydrocarbons, the *alcohols*, constitute highly important members of the group. The simplest METHYL ALCOHOL, CH_3OH , is widely used in the arts as a solvent, and is frequently drunk as an intoxicant—often with disastrous effects, as will be pointed out; ETHYL ALCOHOL, C_2H_5OH , the next member of the group, is one of the most ancient of reme-

dies and perhaps the most widely used known drug. Its importance in dietetics, in therapeutics, and in toxicology is far-reaching. The higher alcohols, *propyl*, C_3H_7OH , *butyl*, C_4H_9OH , and *amyl*, $C_5H_{11}OH$, are frequently found in ordinary alcoholic drinks, and, as *fusel oil*, constitute important poisonous principles.

AMYLENE HYDRATE, dimethyl ethyl carbinol, $(CH_3)_2(C_2H_5)COH$, is a hypnotic of this same series.

The oxides of the hydrocarbons, *ethers*, are represented chiefly by ETHER, diethyl oxide, $(C_2H_5)_2O$, the most widely employed general anesthetic. The aether of the Pharmacopœia contains a small percentage of alcohol, but a new synthetic ether has been introduced commercially and is under investigation. METHYLALE, methylene dimethyl ether, $CH_3OCH_2OCH_3$, and ACETAL, diethyl acetal, $C_2H_5OCH(C_2H_5)OC_2H_5$, have also been introduced, as anesthetic and hypnotic respectively. A few compound ethers, *esters*, compounds of an alcohol (or phenol) with an acid are of importance. Most of these bodies by the interposition of the acid molecule are weaker than the ethers of analogous structure. The action of many is unknown. Thus methyl formate (CH_3OCOH) is a constant constituent in crude wood-alcohol and may be one of the factors in its toxic action. Ethyl formate (C_2H_5OCOH) is extensively used in the manufacture of artificial rum and arrack. Amyl acetate ($C_5H_{11}OC(OCH_3)$) and the allied ethyl butyrate and iso-amyl iso-valerate are widely employed as artificial flavors, pears, pineapple and apples, respectively. Most of the fruit essences are mixtures of these and allied esters.

The addition of alcohol to the nitrous acid radical forms the ester, AMYL NITRITE ($C_5H_{11}ONO$), so widely employed as a vasodilator. In this preparation, however, the NO ions play an important part. The esters formed with carbamic acid, URETHANE, ethyl carbamic ether, $(C_2H_5)CO(NH_2)$, $((OC_2H_5)CO.NH_2)$, and HEDONAL $((C_2H_5)CO(NH_2))$, $((OC_2H_5)CO(NH_2))$, a similar ester with amyl alcohol, have wide applicability as reliable hypnotics. VERONAL, diethyl malonyl urea, $(C(C_2H_5)_2CO(CONH_2)_2)$, is a recent valuable addition to this series.

A number of important *aldehydes* are used: PARALDEHYDE (C_2H_4O), is one of the oldest, while within comparatively recent years several sulphur aldehydes have been introduced; SULPHONAL $(CH_3)_2C(SO_2)(C_2H_5)_2$, TRIONAL $(CH_3)(C_2H_5)C(SO_2)(C_2H_5)_2$, and TETRONAL $(C_2H_5)_2C(SO_2)(C_2H_5)_2$ are the most important of these. Sulphonal is the mildest, trional stronger; tetronal is considered almost dangerous.

A number of halogen derivatives have been formed and are valuable. The addition of chlorine, bromine, or iodine to the hydrocarbons have resulted in CHLOROFORM, $CHCl_3$, BROMOFORM, $CHBr_3$, and IODOFORM, CHI_3 , the first in wide use as an anesthetic; bromoform as an antispasmodic (still under trial), and iodoform, a valuable antiseptic, showing its alcoholic relationships only in certain forms of poisoning. In these halogen compounds the Cl, Br, and I

ions modify or entirely change the action of the hydrocarbon nucleus. In the case of all of the chlorine synthetics a certain poisoning of the heart muscle seems to accompany the combination. Ethyl compounds are *ethyl chloride*, C_2H_5Cl , a useful general, as well as local, anesthetic, and the closely related *ethylene* and *ethylidene* compounds (CH_2Cl-CH_2Cl) and $(CH_2CHCl)_2$, symmetrical and unsymmetrical ethane derivatives, are unsafe. *Methylene chloride*, CH_2Cl_2 , has also been used as a general anesthetic. Aldehyde combinations with chlorine are: *CHLORAL*, CCl_3COH , trichloraldehyde, or more properly chloral hydrate (chloral + water); *BUTYL* or *CROTON CHLORAL* (trichlor butyl-aldehyde + water), $(C_2H_4Cl)_2CO + H_2O$; *CHLORALOSE* (chloral + glucose); *CHLOROTONE* (chloral + acetone) $(CCl_3(CH_3)_2OH)$; *CHLORALAMIDE* (chloral formamide), $(CCl_3CH(OH)CONH_2)$; *URAL*, $(CCl_3COH) + (OO_2H_4)(CO(NH_2)_2)$, a combination of chloral and urethane; *SOMNAL*, ural in which another ethyl replaces the OH in chloral. This by no means exhausts the list of these alcohols and their derivatives. Synthetic chemists continue their kaleidoscopic manipulations, and undoubtedly many more useful members of this class will be introduced. The great necessity in the chloral series has been to devise combinations that would have a more agreeable taste than chloral, and further, compounds that would not possess cardiac-depressing effects. For the greater part it would seem that only with the weakest of these had this been accomplished. Efforts have further been directed to the obtaining of a chloral derivative in combination with an analgesic. *HYPSAL*, a combination of chloral and antipyrine, was such, but it does not seem to have met with favor.

The physiological action of all of the compounds shows a marked qualitative resemblance. With the advance in the series, from lower to higher, until insolubility or non-absorbability militate, they show an increasing quantitative reaction, and from the chemical composition alone a fairly accurate estimate may be made of the grade of this increase in the physiological action. Naturally with the introduction of other active radicals, both qualitative and quantitative variations are introduced.

It has been thought that the action of this group of bodies depends in large part on their special affinity for certain classes of compounds as found in both plants and animals. Disregarding the evidences derived from anesthetization of the leaves of the sensitive *Mimosa*, etc., the studies of Meyer and Overton seem to represent the best interpretations of the cause of action of these bodies. They have elaborated and confirmed in great detail the belief that it is because of the affinity that these bodies have for lipoids, or fatty substances, that their physiological activities are what they are, and because of the great abundance of these lipid substances, cholesterol, lecithin, etc., in the nervous structures, there is, as it were, a localized action in these organs, and in a few others rich in fat, the liver (cirrhosis) etc. The ganglion cells of the central nervous system are particularly rich in lipid substances, and hence

their great affinity for this group of substances. The further evidence of Mann, Vas, Nissl, and others seems to lend some histological foundation to the hypothesis.

It is upon the nervous structures, then, that these bodies act, and the effect is one of gradual poisoning. As may be pointed out later, certain clinical symptoms accompanying the use of members of this series may seem to show irritation and exaltation of function, but even these signs of stimulation are capable of being interpreted in line with the general hypothesis of primary and persistent nerve-cell depression.

The grade of activity of these substances would seem to depend upon the relationship of the affinity of these bodies for water and for oily substances, and physicochemical methods have introduced a series of criteria by which their toxicity, for lower animals at least, might be measured. Thus methyl alcohol is freely soluble in water and dissolves in oil (olive oil being the oil usually used) with great difficulty. Hence its ability freely to enter into the protoplasm is limited, and its toxic action may be inferred to be slight. Amyl alcohol is less freely soluble in water and readily soluble in oils, its coefficient is higher and its toxic power much greater.

Overton has constructed a table showing the results of a series of experiments on plants and lower animals relative to this point.

Alcohol—Alcoholis—Alcohol. U. S. P.

Definition.—A liquid composed of about 92.3 per cent. by weight, or 94.9 per cent. by volume, of absolute ethyl alcohol, and about 7.7 per cent. by weight of water.

Description and Properties.—A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Miscible with water, ether, or chloroform in all proportions. It is inflammable, and readily volatilized even at low temperatures. Alcohol should be kept in well-closed vessels, in a cool place, remote from lights or fire.

Official Preparation.

Alcohol Dilutum—Alcoholis Diluti—Diluted Alcohol (U. S. P.).—A liquid composed of about 41.5 per cent. by weight, or about 48.9 per cent. by volume, of absolute ethyl alcohol, and about 58.5 per cent. by weight of water. It should be kept in well-closed vessels, in a cool place, remote from lights or fire.

Alcohol Absolutum—Alcoholis Absoluti—Absolute Alcohol (U. S. P.).—**Definition.**—Ethyl alcohol, containing not more than 1 per cent. by weight of water.

Description and Properties.—A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Very hygroscopic. It should be kept in well stoppered bottles or tin cans, in a cool place, remote from lights or fire.

Spiritus Vini Callici—Spiritus Vini Callici—Brandy (U. S. P.).—**Definition.**—An alcoholic liquid obtained by the distillation of the fermented unmodified juice of fresh grapes.

Description and Properties.—A pale amber-colored liquid, having a distinctive odor and taste and a slightly acid reaction. Its specific gravity should not be more than 0.941, nor less than 0.925, corresponding, approximately, to an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume, of absolute alcohol.

Spiritus Frumenti—Spiritus Frumenti—Whisky (U. S. P.).—**Definition.**—An alcoholic liquid obtained by the distillation of the mash of fermented grain, such as Indian corn, rye, wheat, and barley, or their mixtures.

Description and Properties.—An amber-colored liquid, having a distinctive odor and taste and a slightly acid reaction. Its specific gravity should not be more than 0.945 nor less than 0.924, corresponding, approximately, to an alcoholic strength of 37 to 47 per cent by weight, or 44 to 55 per cent. by volume, of absolute alcohol. Whisky should be at least four years old.

Vinum Album—Vini Albi—White Wine (U. S. P.)—**Definition.**—An alcoholic liquid made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* (not ord. *Vitis*), freed from seeds, stems, and skins, and subjected to the usual cellar treatment for fining and aging.

Description and Properties.—A pale amber colored or straw-colored liquid, having a pleasant odor, free from yeastiness, and a fruity, agreeable, slightly spirituous taste, without excessive sweetness or acidity. It should contain not less than 7, nor more than 12, per cent. by weight—equivalent to 8.5 to 15 per cent. by volume—of absolute alcohol.

Vinum Rubrum—Vini Rubri—Red Wine (U. S. P.)—**Definition.**—An alcoholic liquid made by fermenting the juice of fresh red-colored grapes, the fruit of *Vitis vinifera* L. (*Vitis*), in the presence of their skins, and subjected to the usual cellar treatment for fining and aging.

Description and Properties.—A deep-red liquid, having a pleasant odor, free from yeastiness, and a fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive sweetness or acidity. It should contain not less than 7, nor more than 12, per cent. by weight—equivalent to 8.5 to 15.3 per cent. by volume—of absolute alcohol.

Unofficial Alcoholic Preparations.

Spiritus Rectificatus—Spiritus Rectificati—Rectified Spirit—contains 85 per cent. by weight of absolute alcohol.

Proof Spirit contains 42 per cent. by weight of absolute alcohol, together with a peculiar volatile oil and other foreign material.

Gin is usually distilled in Holland from rye or barley, and flavored with juniper berries and hops. It contains about 42 per cent. by weight of absolute alcohol, and is probably more diuretic than other liquors because of the oil of juniper it contains.

Rum is obtained by distilling fermented molasses, having about the same alcoholic strength as gin.

Port Wine is prepared by adding spirit during the process of manufacture, bringing the alcoholic strength up to 30 or 40 per cent.

Sherry Wine—a dry wine, having from 20 to 35 per cent. of alcohol.

Sparkling Wines contain from 8 to 10 per cent. of alcohol. They are more or less sweet wines, and are charged with carbonic acid, being bottled before fermentation is completed, the grape-sugar, in consequence, not undergoing conversion into alcohol. The sparkling wines are champagne, hock, and sparkling catawba.

Sweet Wines are those in which the sugar has not all been converted into alcohol, the alcoholic strength being therefore relatively low—from 6 to 7 per cent. Among the sweet wines may be classed Angelica, Madeira, Malaga, Muscatel, Tokay, etc.

Dry Acid Wines are those in which the fermentation is complete, the alcoholic strength varying from 5 to 7 per cent. They are such as California Henck, Ohio and Kentucky Catawba, Rhine and Moselle wines, Hochheimer, Dürkheimer, Deidesheimer, etc.

Light Red Wines contain 5 to 7 per cent. of alcohol, and are astringent, containing tannic acid and the coloring matter of the grape. They are Claret, Red Rhine, Concord, Hungarian, etc.

Beer, Ale, and Porter are prepared by fermenting malted grain with hops and adding other matters. Beer contains from 2 to 3 per cent. of alcohol; ale and porter, from 4 to 6 per cent., besides carbonic and lactic acids, malt extract, various aromatics, and potassium and sodium salts.

Cordials—These are mixtures of distilled brandies with high sugar percentage added. The characteristic flavor is derived from volatile oils from the fruits or seeds added to the alcohol mixture before distilling.

Antagonists and Incompatibles.—The motor, cerebral, and cardiac depressants are antagonistic to moderate amounts of alcohol.

Synergists.—The motor excitants, atropin, ether, and the diffusible stimulants.

Physiological Action.—Few drugs have occasioned such diversity of opinion regarding their physiological action and uses as alcohol.

Externally and Locally.—Ethyl alcohol is a distinct bactericide. Applied to the skin it is detergent, bactericide, and extracts water from the skin. When applied in full strength to the skin it produces a sensation of coldness, due to rapid evaporation. Should the drug be diluted, the sensation of cold is greatly diminished. If evaporation be prevented, the effect is that of heat or burning, owing to the penetration of the drug through the epidermis and its chemical influence upon the tissues beneath.

Its effect upon the mucous membranes of the mouth and esophagus is similar in kind to that upon the skin, save that the former are more readily affected. The mucous membrane becomes whitened and corrugated, because of the coagulation of albumin and the abstraction of water. A stimulation of the gastric functions is reflexly due to its local action in the mouth.

Internally.—Digestive System.—Taken into the stomach there is a sensation of heat and marked increase of saliva, due to reflex action; the blood-vessels of the stomach are dilated, with accompanying increase in the secretion of mucus and of the gastric juice. It is not certain whether pepsin is increased in amount or not.

The action on digestion depends largely on the grade of concentration of the alcohol in the gastric contents and upon the individual. In general it may be said that in strengths up to 5 to 10 per cent. the digestive functions of the stomach are improved, although even this degree of concentration may partly destroy the action of the enzymes present. In strengths above 5 to 10 per cent., in some individuals even less, gastric digestion is interfered with. Alcohol increases the muscular activity of the stomach, and aids in the absorption of fluids from the stomach. Immoderate amounts, or the daily and intemperate use of the drug, lessen the flow of gastric juice and increase the secretion of mucus, producing a catarrhal condition.

The action of alcohol on the small intestines is not marked, since most of it is absorbed. When large amounts are taken, as at a large dinner, or during a debauch, diarrhea, in large part due to peristaltic stimulation, is a frequent symptom.

Circulatory System.—Taken into the stomach, alcohol reflexly and rapidly stimulates the heart before absorption can take place, the effect upon the circulation persisting after the drug is absorbed. Cardiac action is rendered more rapid and forcible from small amounts, but it is not certain why. Arterial tension is raised, although the peripheral blood-vessels are dilated, especially those of the skin, owing to the depression of the vaso-constrictors. Toxic doses depress the heart and still further dilate the arterioles, greatly lowering the blood-pressure. This action of alcohol, in causing the heart to beat stronger and faster, at the same time dilating the

blood-vessels—particularly those of the peripheries—renders the drug one of the most valuable diffusible stimulants.

Excessive doses of alcohol greatly depress or paralyze the heart, while an enormous amount, when taken upon an empty stomach, by reflex action occasioning cardiac paralysis, may produce instantaneous collapse. The function of the red corpuscles is impaired, preventing the oxyhemoglobin from parting with its oxygen, consequently retarding oxidation to a slight extent.

Nervous System—The chief action of alcohol is on the nervous system. All portions of the nervous system are affected at once by the drug, but there seems to be a regular series of poisoning stages with well-recognized clinical signs. Thus it may be said that (a) the highest cerebral centers first show the toxic effects; (b) the motor-conducting neurons come under the effect of alcohol next; (c) the sensory centers then succumb, and (d), finally, the medullary centers of respiration and circulation are markedly involved.

In the cerebral cortex the least highly organized of the faculties are primarily modified. The last of the evolutionary developments crumble first. Thus the finer ethical sentiments and regards for the proprieties become abrogated. Judgment becomes affected and bad bargains are made; stupid jokes are thought immoderately funny. Witty sallies are indulged in, which are usually flat.

For certain individuals, particularly in some in whom inhibition is a powerful deterrent to speech and expression (for alcohol cuts off inhibition), and in others from the necessity for stimulus because of antecedent indulgences, alcohol is a powerful cerebral excitant. Under its milder influences such people are often thoroughly aroused and frequently can do their best work. Usually, however, such work, if unrevised, will show, and particularly for the genius of other than the first rank, many intellectual lapses, and it is highly doubtful if alcohol ever induces any real increase in the intellectual powers, save in the certain rare individuals mentioned.

Following or coincidental with the breaking down of the higher intellectual faculties there is a weakening of the coordinating mechanism of motion. The fiber tracts do not react properly and irregularities of movement, in the lips in speech, in the eyes in winking and seeing double vision, in the arms in eating or drinking, in the legs in walking, are observed.

Sensory disturbances, anesthesia, develop side by side with the other changes. An early loss of tactile impressions is apparent. The drinking man drops his cigar, or his knife or fork. His loss of muscle sense contributes to his unsteadiness in walking, or in the movements of his arms. A general mild anesthesia contributes to the sense of well-being, since cold, fatigue, slight discomforts are no longer felt; hence one of the great attractions of this class of narcotics for all those who have painful conscious states. It affords an escape from present states of intense consciousness and is eagerly sought after. The urogenital sensory segments are late in sharing in the general anesthesia.

In profound alcoholic narcosis the medullary centers are last seriously involved, the giving out of the respiratory center being the cause of death. Thus impaired consciousness, paresis or paralysis, anesthesia and respiratory failure summarize the march of the toxic action of this drug.

Respiratory System.—Medicinal amounts deepen and accelerate respiration: large doses render the breathing slow and shallow—these effects being due to stimulation or depression of the respiratory center. The stimulation may be secondary rather than primary, due in part to its action on the stomach walls. Death from a toxic dose of alcohol usually results from paralysis of respiration. It may be noted that under toxic dosage of the drug the amount of carbonic acid exhaled is diminished.

Absorption and Elimination.—Alcohol is very rapidly absorbed and circulates in the blood. It is eliminated unchanged in small proportion to the quantity ingested, owing to the fact that the greater proportion of it is oxidized in the body. The kidneys, lungs, skin, and liver share in the excretory process. It is estimated that at least 90 per cent. is oxidized. The products of oxidation are not definitely known, but they are assumed to be acetic acid and CO_2 and H_2O .

Kidneys—Alcohol increases the amount of urine formed. The causes are partly due to increased blood-flow, a slight increase in pressure, and perhaps some direct action on the epithelium. Single large doses are known to cause albuminuria, and chronic kidney changes are almost universal in chronic alcoholism. Uric acid secretion does not seem to be modified.

Temperature.—Alcohol is an antipyretic of considerable power. This action is owing largely to the cooling of the blood through dilatation of the cutaneous blood-vessels, subjecting the warm blood from the interior of the body to the cooling influence of the atmosphere, and to the cooling of the surface of the body from the evaporation of sweat. The power to resist cold is diminished by the habitual use of alcohol. The drug would be useful in stimulating warmth in a person who had been long exposed to cold, but only in a warm room. Then, by rapidly dilating the blood-vessels of the skin and allowing the blood to flow to the surface, the subject is favorably affected by the external heat, while there is less danger of congestion in some internal organ.

Metabolism.—The action of alcohol in metabolism is intricate. Its many factors have not yet been determined with accuracy. Its rapid absorption and subsequent rapid oxidation brings about an increase in the energy of combustion, and thus alcohol may up to a certain point take the place of certain food elements of the body. Neumann, Atwater, and others have almost conclusively proved that alcohol may be said to save the proteids, and temporarily take the place of carbohydrates and fats as foods. Neumann's classical experiment is worth bearing in mind in this connection. It is known that in the absence of carbohydrates and fats in the diet, the

proteid elements of the body are burned in their place. This is made evident in an increase of nitrogen elimination from the urine; and conversely when surplus quantities of fats and carbohydrates are supplied the nitrogen elimination falls. This general result served as a criterion in a series of experiments in which alcohol was given in the place of fats more particularly and the results on the nitrogen elimination noted. Thus in the experiment referred to a time schedule of thirty-five days, divided in six periods, was followed out. Under a constant diet for five days a nitrogenous equilibrium was first established; then for four days the amount of fat was reduced one-half; this resulted in an immediate and steady increase in the amount of nitrogen eliminated, showing that the proteids were being used to supply the fat deficiency. At the end of this second period alcohol calorically equivalent to the omitted fat was added. After a short period the nitrogen elimination commenced to diminish and at the end of ten days had sunk to the level of the equilibrium line. At this time the full amount of fat, plus the alcohol, was resumed, and the nitrogen elimination became less than before, thus showing that the alcohol had taken the place of a certain amount of fat and spared the proteid. The experiment terminated by a resumption to former conditions when the nitrogen equilibrium was once more attained.

A similar lesson may be learned from the obesity of alcohol users. These accumulate fat because the addition of the alcohol supplies a readily oxidizable substance and the normal fat is not called on for purposes of combustion.

In some particulars alcohol retards certain combustions, interfering at times with the full oxidizing properties of the liver cells, but the precise limits of activity are inadequately known.

In reference to the action of alcohol on the protective agents of the blood-plasma the evidence is inconclusive. It seems fairly well established that continued alcohol-taking reduces the resistance of the body to infections, but it also seems probable that in infectious diseases, for the non-alcoholic, alcohol contributes in some manner to the antitoxic properties of the blood serum. The studies on this subject, however, are far from being conclusive.

Eye—The excessive use of alcohol may produce amblyopia, watery eyes, and congested conjunctivæ.

Untoward action is fully described under "Poisoning."

Poisoning—The untoward or poisonous action of alcohol may be divided into what are known as *Acute* and *Chronic Alcoholism*.

Acute Intoxication.—The general physiological phenomena leading up to acute poisoning by alcohol have been discussed, but the clinical picture, while too familiar, may be of service in differential diagnosis. The patient thoroughly under the influence of the drug is lying prostrate, usually in a more or less loose and lax position. His clothing is apt to be much awry and soiled and frequently wet with urine from the diuresis and gradual increase of loss of ability to control the acts of toilet. On inspection the face is found either

flushed and warm in the lighter or early forms of intoxication, or cold and cyanosed in the deep narcoses. The breathing is deep early; or shallow and stertorous later; always in this condition slower than normal (8-10 per minute), in contrast to 5-6 per minute for severe opium poisoning. The pulse may be full and normal in rate, or in the very severe grades small and thin and wiry. The body temperature by rectal thermometric reading is reduced invariably 1 to 2 or even 4° F. The eyes are suffused and bloodshot, the pupils moderately contracted or dilated, depending on the depth of the narcosis. In fatal cases wide dilatation is the rule. The mouth is apt to be moist unless long exposure and stertorous breathing have dried it. An odor of alcohol is present. Too much stress should not be laid on this odor. Mistakes are too often made in the diagnosis between fractured skull and alcoholism because the breath smells of alcohol. Great care must be taken when the two conditions are present. Further examination of the patient will show him difficult or impossible to arouse, and only by pressure on a prominent nerve trunk can a response be obtained. The knee-jerks are abolished, and may be the corneal reflex. Catheterization of the bladder usually reveals a comparatively full bladder, and the urine does not contain any copper-reducing substances—compare with chloral poisoning; diabetes; some skull fractures.

A type of subacute alcohol poisoning is known as *Delirium tremens*. It usually follows a bout of heavy continuous drinking. Its onset may be gradual; or following an injury, psychical or physical shock, or even an attack of infectious disease, the train of symptoms may develop very rapidly. Thus in some of this latter type acute delirium tremens may follow immediately after a fracture or during an attack of pneumonia. Sudden grief may also precipitate an attack.

In the gradual cases the early symptoms are those of gradually increasing restlessness; the patient must be up and doing. Wakefulness or insomnia develops and the patient loses his appetite. Muscular tremor of a very fine type, or occasionally muscular twitching or jerking, may be present. There is an increase in all of the patient's reflexes. Irritability is marked, and from the increasing meningeal or cerebral irritation visual and auditory hallucinations begin to develop. At first these are absent in the daytime, and only become bothersome as the patient retires, but later the hallucinations become more marked. They often are representative of the patient's regular occupations; but more classically the visual hallucinations are terrifying in their character—sometimes of the nightmare order—frequently of animals, etc. From this condition, the cerebral irritation progressing, acute maniacal delirium develops. This may end by a fatal collapse.

Chronic alcoholism is generally the result of the continuous and excessive use of alcohol. The symptoms vary according to the individual case. There may be (1) the moderate or immoderate daily drinker; (2) the periodical inebriate. The periodical inebriate,

strictly speaking, is not an inebriate at all, as a rule. There is a wide-spread distinction between the true periodical inebriate or the dipsomaniac and the inebriate proper. An alcoholic patient becomes insane because he drinks; a dipsomaniac is insane before he commences to drink. Dipsomania may be complicated by alcoholic symptoms, but alcoholism never leads to true dipsomania. Alcoholism is an intoxication having as its cause alcohol, while dipsomania has as its origin a congenital defective condition and alcohol is a secondary factor, which may be replaced by any other intoxicant leaving the syndrome all its psychologic characters. The alcoholic element is a mere manifestation determined at the outset of the attacks.

The habitual drinker sooner or later suffers from disturbed digestion, gastric catarrh, and irregularity of the bowels; his face is usually puffed and bloated, while the capillaries, especially of the cheeks and nose, become permanently dilated, marked acne rosacea not infrequently developing in the latter organ.

The description of types of alcoholic psychoses should be sought for in works on psychiatry. These psychoses are of immense practical importance.

Pathological changes induced by chronic alcoholism are very numerous. Chronic congestion and irritation of the stomach lead to catarrhal gastritis. In the liver new connective tissue forms, particularly in the acini most in contact with the alcohol undergoing combustion. Chronic cirrhosis results with its train of symptoms: ascites, jaundice, biliary infections, etc. Fatty degeneration is common. The circulatory changes are prominent. In beer-drinkers, particularly in those who drink large quantities, there is cardiac dilatation and hypertrophy with degeneration. These patients, usually workers connected with brewing industries, develop the so-called "beer heart." The alcohol, plus the large amounts of water, dilates the stomach; there is irregular and slow, or galloping pulse, with dyspnea and cyanosis.

The continued heart strain leads to myocardial degeneration and to fatty changes. Vessel changes of an arteriosclerotic nature are also present. In the kidneys the vascular changes are the most important factors. These lead to kidney inefficiency, and the irritation or suboxidation to new connective tissue formations, with the development of chronic forms of nephritis.

The nervous tissues are profoundly affected. Changes in the peripheral nerves, nerves of trophic influences, spinal cord, optic nerve, and brain are frequent. In the peripheral nerves a neuritis may develop, leading to isolated paralyses or anesthesia, or to multiple neuritis and general peripheral sensory disturbances. Alcoholic paralysis usually affects the extensors, causing wrist-drop and foot-drop, and is, as a rule, accompanied with some sensory disturbances (see Lead Palsy, Arsenical Neuritis). Trophic disorders, herpes, urticaria, ulceration, etc., are not uncommon. In the spinal cord a partial degeneration of the sensory neurons of the posterior

columns leads to a pseudo-tabes, the symptoms closely resembling those of locomotor ataxia. In the eye partial or complete blindness may occur, amblyopia and amaurosis being particularly prevalent following the use of methyl alcohol. Scotomata are common, particularly in reds and greens. In the brain an acute psychosis—*delirium tremens*—may be set up, or a slow grade of alcoholic dementia supervene.

Treatment of Acute Alcoholic Poisoning.—The stomach should be emptied of all unabsorbed alcohol; cautious inhalations of ammonia should be given, accompanied by the internal administration of black coffee. The patient should be put in warm blankets, made to perspire freely, and if there is great danger of collapse, artificial respiration should be practised and strychnine should be administered. Alcohol derivatives should be avoided.

Treatment of Delirium Tremens.—The management of this phase of alcoholism requires great skill and judgment. The main indications are:

(1) *Elimination*.—By diaphoresis, catharsis, diuresis, warm baths, etc.

(2) *Support*.—Some alcohol may be necessary. Easily digested food. Enemata if necessary.

(3) *Quiet*.—Hypnotics: opium, chloral, bromides.

Treatment of Chronic Alcoholism.—The therapeutics of chronic alcoholism or inebriety turns, like that of any other morbid condition, on the definition of inebriety. In such conditions the relative element is largely involved, not merely as to quantity drunk, but also as to the character of the individual affected. A thoughtful and extended experience with dipsomaniacs will convince most observers that the great majority of them suffer from a disease possessing usually a distinct and traceable etiology, and resulting from either inherited or acquired neurosis. It is a condition akin to epilepsy; the treatment of dipsomania, therefore, turns on the discovery of the conditions preliminary to the drinking period and the determination whether this can be prevented by dietetic and therapeutic methods, as is done in cases of epilepsy.

The medicinal agents most serviceable in the treatment of chronic alcoholism are strychnine, atropine, small doses of the alteratives, arsenic, potassium iodide, and mercury, while phosphorus and other restoratives and tonics will frequently be found useful.

The hygienic surroundings should be of the best, and the treatment should include a nutritious, non-stimulating diet taken with regularity, and the free use of fruits and vegetables. Close attention should be paid to the condition of the bowels and skin, and among other remedial influences should be mentioned laxatives when necessary, balneotherapy, mental and moral treatment, and, above all, change of scene and engaging mental occupation.

Inebriety is so varied in form, so subtle in operation, so intricate in development, and so complex in causation that its treatment is no easy task. Its management, therefore, is management of a pro-

tracted disorder, where any "specific" becomes an absurdity, since the patient, and not the disease, requires treatment.

From time to time various drugs have been heralded as specifics in the treatment of alcoholism, certain "cures" (*sic*) acquiring an influence among the ignorant and unscientific wholly at variance with therapeutic value of these vaunted remedies. It is superfluous to say that for a skilled and enlightened professional judgment the rationale of intemperance and the agents serving to mitigate the malady present a problem far too complicated to be grasped by the empirical understanding, operating even under the most ingenious motives.

Therapeutics.—Externally and Locally.—ALCOHOL is an efficient application for *contusions, sprains, and indolent ulcers*, and is also serviceable in hardening the skin and preventing the formation of *bed-sores*. It is a useful hemostatic to check *capillary oozing*, and, being a powerful antiseptic, is available in all wounds. *Uterine hemorrhage* is controlled by inserting in the cavity of the uterus a tampon saturated with the drug.

Its local anesthetic properties render alcohol valuable in relieving irritation of the skin in *urticaria, frost-bite*, etc.; it also serves as an efficient gargle in *diphtheria* and *acute pharyngitis*.

Alcohol is an excellent local application to counteract the caustic action of carbolic acid.

ALCOHOL, or BRANDY, has been successfully employed to *harden nipples* and prevent their cracking.

A very efficient means of reducing *temperature in fever* is to bathe the skin with ALCOHOL, the method being also useful to check *excessive sweating*.

Internally—ALCOHOL, in the form of WINE, BEER, or ALE, taken before or during meals, is an efficient stomachic. *Atonic dyspepsia* and the *weakened digestion* attendant upon *convalescence from acute diseases* are greatly benefited by some form of alcohol. When digestion becomes impaired as the result of physical or mental exhaustion the drug serves a useful purpose as a tonic. In percentages above 10 per cent. alcohol hinders, rather than aids, digestion. It is obviously contraindicated in gastritis.

The wisdom of using the drug, however, in the conditions mentioned may be questioned, because of the danger of establishing the desire or habit, particularly in the case of neurotic women and those whose debilitated energies call for renewed and increasing quantities of the drug.

Frequently the physical or mental depression, the peculiar, irresistible craving for stimulants, the insomnia and fitful appetite and disposition which urge recourse to alcoholic indulgence, are but the early manifestations of a brain-and-nerve degeneration, the impulse to drink being only the physical demand for relief.

There is less danger attending the administration of alcohol in conditions of lowered vitality and weakened digestion in old people than in the young and middle-aged. The drug is decidedly contra-

indicated in persons of average health and fair digestion, although beneficial in the aged, whose powers are failing from natural decline.

The anesthetic and sedative properties of alcohol, especially in the form of CHAMPAGNE, which contains carbon-dioxide gas, may frequently control *obstinate vomiting*. *Gastralgia* and the *pain arising from flatulence* are often readily relieved by BRANDY.

As a pure cardiac stimulant, alcohol is remarkably serviceable in *syncope*, *asphyxia*, *exhausting hemorrhages*, *diphtheria*, and *collapse* where death seems imminent. In counteracting the effects of *narcotic poisons* it is almost indispensable; it is of some service for the treatment of *poisoning by venomous reptiles*, but it is not a specific in any degree.

It is a common practice with some surgeons to precede the inhalation of chloroform with the administration of 1 or 2 ounces (30.0-60.0 Cc.) of WHISKEY or BRANDY, to induce a partial anesthesia before giving the general anesthetic.

In certain stages of various acute diseases, such as *typhoid*, *typhus*, *small-pox*, *pneumonia*, *cerebrospinal meningitis* *capillary bronchitis*, etc., alcohol is one of the most potent and valuable remedies. It should be employed in these cases only when there is marked depression of the circulatory apparatus, characterized by a weak, rapid, soft, and irregular pulse with a feeble sound of the heart and threatened *syncope* or *delirium*.

Alcohol is beneficial in such cases as the foregoing when by its use the tongue is moistened, the pulse and respiration are slowed, the restlessness and delirium quieted, and the skin becomes less parched.

Should the drug increase the pulse rate and intensify the nervous manifestations, it is an indication that the dosage is excessive, in which event it may be well to discontinue the administration altogether. Even where the action of the drug is favorable, it is doubtful whether it should ever be given in fevers throughout the twenty-four hours, administration being advisable rather when the muffled or absent first sound of the heart indicates impending cardiac failure. This usually occurs during the interval between midnight and 7 A. M. Stimulation should therefore begin before midnight, and full doses—say 1 fluidounce (30 Cc.)—be given every three hours, full doses being of more service than repeated smaller amounts.

It should be remembered that alcohol generates no new energy, but simply enables a person to utilize in a short period all his available reserve force. It is, therefore, a remedy for temporary use only, and the utmost discrimination and judgment are requisite to its proper administration.

In *pyemia*, *septicemia*, *erysipelas*, and *diphtheria* alcohol is frequently one of our most efficient remedies. Experience tends to show that tuberculous patients for the most part get along better without alcohol.

Small quantities of alcohol appear to exert a favorable action in *functional impotence*.

Its sedative action, or possibly its property of increasing intracranial blood-pressure, renders alcohol valuable as a hypnotic in mild insomnia, particularly in old people. It may be useful in some cases of insomnia if the patient does not continue to work. It is a very useful hypnotic in the delirium of acute infectious diseases.

The principal therapeutic use for alcohol, perhaps, is as a cardiac stimulant. In syncope, shock particularly, it is invaluable. In acute colds, which are largely local circulatory disturbances, alcohol may restore balance.

Contraindications.—In genito-urinary affections alcohol does more harm than good. It is ordinarily contraindicated in nephritis and diseases of the liver, gout, gleet, gonorrhea, and in urethritis. The malt liquors and sweet wines should not be given in diabetes nor to persons suffering from eczema. Alcohol is also dangerous in hypertrophy of the heart and excessive cardiac action.

Administration.—When possible, alcohol should always be taken with food. Brandy is the best astringent, and brandy and champagne are the best preparations to allay nausea. Whiskey is the least constipating, and gin the most diuretic. As regards their sedative action, there is no preference, whichever is most agreeable to the patient and least affects the head being advisable. As stomachics either claret, beer, or ale is most efficacious in improving the appetite. In cases of fermentative dyspepsia sweet wines and malted liquors are more injurious than beneficial, whiskey or brandy being preferable.

When desired as diffusible stimulants in cases of cardiac failure, brandy or whiskey only should be employed, which preparations may be given hypodermically.

GENERAL ANESTHETICS.

Ether, chloroform, and a number of related compounds, ethyl chloride, methylene chloride, etc., form a group of these alcohol derivatives, in which the property of rapid volatilization causes the formation of vapors which are capable of rapid absorption by the respiratory mucous membrane with the production of general anesthesia. Nitrous oxide causes a similar anesthesia, but its mode of action is very dissimilar.

To Dr. Oliver Wendell Holmes is due the credit of proposing the term "anesthetic." This group occupies a position between the preceding one and the next—Hypnotics.

The use of drugs to abolish pain in surgical operations has probably never been entirely forgotten, but their general and systematic employment only commenced with the use of nitrous oxide by Wells, in 1844, and of ether by his pupil Morton. Shortly afterward a great number of substances were tried by Simpson, with the result that he chose chloroform as being the most convenient and

safe. The power of producing anesthesia, as already pointed out, is common to most of the substances of the fatty or alcohol series. But it is greatly modified by a number of circumstances; the position in the fatty or alcoholic group of the radical or alkyl which forms the basis of the substance, and the nature of the element or radical with which the alkyl is combined, being two prominent ones. Thus in the case of the alkyls, their action differs according as they are combined with hydrogen in the hydrides, with hydroxyl, OH, in the alcohols, or with both oxygen and hydroxyl, as in the acids.

Some members are useful as hypnotics, simply inducing sleep as one of the first results of their action; although if the dose be large, the sleep may pass into complete unconsciousness or anesthesia, with loss of reflex action. For the production of prolonged sleep a substance is required whose action will be slight, and at the same time prolonged; but for anesthesia a substance is needed that will act rapidly and powerfully, but will be quickly eliminated and cease to act very shortly after its administration is discontinued. Hypnotics therefore are found among the substances which have a heavy molecule, and are either liquid or solid in form, so that they may be given by the mouth, and being absorbed into the blood continue to act for a length of time. Anesthetics are found among the lower members of the series which have a light molecular weight, and are either gases or volatile liquids. Although heavy liquids like paraldehyde, or solids like chloral hydrate, will act as anesthetics when given in large doses, yet their use as such would be very dangerous, for the line between their anesthetic action and their paralyzing action on the respiratory center is very narrow and might easily be crossed by a very slight excess in dose.

An ideal anesthetic should be a substance capable of rapidly and safely producing profound anesthesia, and susceptible of speedy elimination, so that consciousness may be restored soon after withdrawal of the anesthetic, with no discomfort to the patient. The typical anesthetic should also be convenient and safe—a stable, non-irritating, pleasantly odorous, homogeneous liquid, with a boiling-point neither too high nor too low. Unfortunately there is no substance which fully meets these requirements, ether and chloroform approaching nearest to the ideal agent.

Local anesthetics are used to deaden the sensation or abolish the sensibility of the peripheral nerves of a localized, particular area. The most important are—cocaine, carbolic acid, iodoform, eugenol-acetamide, antipyrine, orthoform, anesthesin, holocaine, etc. Some aromatics are also quite powerful anesthetics. The physiological action of local anesthetics is given under the respective agents.

Æther—Ætheris—Ether. U. S. P.

Origin.—A liquid composed of about 96 per cent. by weight of absolute ether or ethyl oxide, $[(C_2H_5)_2O = 73.52]$, and about 4 per cent. of alcohol containing a little water.

Description and Properties.—A transparent, colorless, mobile liquid, having a characteristic odor and a burning, sweetish taste. Specific gravity, 0.716-0.717 at 25° C. (77° F.). Soluble in about ten times its volume of water, with slight contraction of bulk. Miscible, in all proportions, with alcohol, chloroform, petroleum, benzoin, benzene, and fixed and volatile oils.

Ether is highly volatile and inflammable, its vapor, when mixed with air and ignited, exploding violently. It should be kept in well stoppered containers, preferably in tin cans, in a cool place, remote from lights or fire.

Dose, 15-40 minims (1.0-4.0 Cc.) [15 minims (1 Cc.), U. S. P.].

Official Preparations.

Spiritus Ætheris—Spiritus Ætheris—Spirit of Ether.—*Dose,* $\frac{X}{4}$ -1 fluidrachm (1.0-4.0 Cc.).

Spiritus Ætheris Compositus—Spiritus Ætheris Compositus—Compound Spirit of Ether (HOFMANN'S ANODYNE). Ether, 325; alcohol, 650; ethereal oil, 25 parts. *Dose,* 5-60 minims (0.3-4.0 Cc.).

Antagonists and Incompatibles.—The stimulant and anodyne action of ether is antagonized by the arterial sedatives, the tetanizing alkaloids, strychnine, picrotoxin, etc.

Synergists.—The arterial and cerebral stimulants, chloroform and other anesthetics, and alcohol.

Physiological Action.—*Externally and Locally*—Ether when applied to the skin produces intense cold by its rapid evaporation. If it is confined and its evaporation prevented, great irritation is caused. By spraying a part with ether it becomes quickly frozen, marked local anesthesia being produced thereby.

Applied to mucous membranes, it creates considerable irritation, especially of the fauces and respiratory tract when inhaled.

Internally—Digestive System—It is a carminative, increasing peristalsis and the secretions from the pancreas and the salivary and gastric glands, at the same time dilating the vessels of the stomach.

Circulatory System.—When taken into the stomach, ether reflexly stimulates the heart in a manner similar to that of alcohol, raising arterial tension by increasing the force and frequency of the heart's action.

Ether stimulates the heart and increases the blood-pressure when inhaled. It is a diffusible, rapid, and reliable cardiac stimulant.

Respiratory System.—Medicinal doses stimulate and poisonous doses paralyze the respiratory center.

Nervous System.—Ether first occasions a considerable degree of excitement, due to the direct action of the ethyl upon the cerebral cortex. Its action on the cerebrum is similar to that of alcohol, and need not be recapitulated. The action is much more rapid. The stages are all compressed and hence somewhat accentuated. Thus the excitement of the second stage is distinctly comparable with the incoherence and exuberance of the partially intoxicated individual.

Respiration is frequently arrested at the beginning of ether-inhalation, owing to reflex spasm arising from irritation of the peripheral ends of the vagi and trigemini. As the inhalation is

continued the breathing becomes deeper and slower from stimulation of the respiratory center. This part of the nervous system may, in fact, become exhausted from over-stimulation, when the respirations are slow and shallow.

In fatal cases of ether-narcosis the respiration is usually arrested before the cessation of the heart's action.

Absorption and Elimination.—Ether is rapidly eliminated, chiefly by the lungs, but also by the kidneys, which are often considerably irritated by the process.

Temperature.—The prolonged administration of ether produces a great reduction of temperature—doubtless due to the depression of the circulation and respiration and the rapid evaporation of the drug, chilling the body and lungs, rather than to any direct action upon the nervous mechanism presiding over the heat-centers.

In brief, the action of ether when inhaled may be divided into 3 stages for purposes of description. They merge one into another, and in many individuals great variations exist. These may be termed the stage of (1) impaired consciousness, (2) excitement, (3) anesthesia. At first a sensation of choking and irritability of the respiratory mucous membrane is experienced. A greatly increased activity of the salivary glands follows, accompanied by a sensation of prickling or tingling of the hands and feet. The conjunctiva is injected, the face is flushed, the veins of the neck are distended, and there is experienced a peculiar feeling of lightness, together with the beginning of impairment of consciousness. Seeing and hearing are altered, slight insensibility is present, and is sometimes utilized for slight operations. Following this first short period the stage of excitement is usually ushered in by muscular twitchings or muscular struggles. The patient may yell, laugh, cry, curse or pray, struggle or become pugilistic or sometimes amorous. The respirations are usually quickened and irregular from the struggling, and the pulse is rapid and irritable. The pupils are usually dilated.

The stage of anesthesia is usually indicated by muscular relaxation. The patient becomes quiet. The breathing becomes more regular and slower; the heart becomes steadier and slower. The reflexes are abolished, the genital and conjunctival reflexes last involved, and complete anesthesia and unconsciousness with mildly contracted pupils indicate the full action of the anesthetic.

If the inhalation be discontinued before a toxic quantity of ether has been administered, consciousness gradually returns—in some cases almost at once, although some loss of sensation and muscular weakness remain for a while.

The return of consciousness is usually accompanied by retching and vomiting—often by severe rigors, unless care has been taken to keep the patient warm. Great excitement not infrequently attends this stage of etherization.

Treatment of Unfavorable Manifestations.—Withdraw the ether if there be danger of respiratory or cardiac failure, lowering the head if there be indications of the latter, and if respiratory failure be

threatened, as indicated by cyanosis, avoiding a prostrate position. Meanwhile other measures for the relief of cardiac or respiratory failure may be resorted to: artificial respiration, friction, or the electric current to excite respiratory action, one electrode being placed upon the larynx and the other upon the epigastrium. Hypodermic injections may be resorted to—of strychnine, or atropine, or, in desperate cases, of ammonia. Salt infusion may be used. Adrenalin is useful to restore blood-pressure.

Should nausea become too persistent, a hypodermic injection of morphine will usually suffice to quiet it.

Therapeutics.—*Externally and Locally.*—The local anesthetic properties of ether render it valuable in many diseases of the skin, such as *pruritus*, *urticaria*, etc. For treatment of these disorders it is usually combined with some aromatic.

A wet compress saturated with ether has been successfully applied to the forehead for the relief of *epistaxis*. The hypodermic injection of 15 minims (1.1 Cc.) of ETHER in close proximity to the affected nerve has been found valuable in *neuralgia* and *sciatica*.

The hypodermic method of administration has been also practised in the treatment of *shock* and in the threatened collapse following *post-partum hemorrhage*, as well as for the cure of *sebaceous cysts*.

Internally.—ETHER is used as an antispasmodic in order to facilitate certain examinations, the *reduction of dislocations*, and to relieve *pain* in the general practice of surgery, obstetrics, and dentistry. It has been used as an anthelmintic against *tapeworms*.

THE COMPOUND SPIRIT OF ETHER is a stimulant, antispasmodic, and anodyne. It is an efficient remedy for *gastralgia* and *flatulent colic*, and is used to allay many of the symptoms of *hysteria*, as well as *restlessness* and *insomnia* unaccompanied by fever. *Palpitation of the heart* and *nausea* due to the excessive use of tobacco are also greatly benefited by this preparation. In *angina pectoris* and *hiccough* it is an efficient remedy.

Contraindications.—Acute or chronic disease of the kidneys. Dilatation or fatty degeneration of the heart. Subacute bronchitis. Asthma sometimes. Tuberculosis with tendency to hemorrhage. Tumors of the brain or about the neck. Atheromatous condition of the arteries. Enlarged tonsils, chronic alcoholism, or aneurism.

It is necessary at times to give an anesthetic in the foregoing cases, and the surgeon is justified in the use of ether, but the administration should be extremely careful and conducted under skilled supervision whenever the above contraindications exist—particularly in conditions of dilated or fatty heart or chronic alcoholism. Any condition which might prove harmful by reason of the retching and straining, as hernia, etc., sometimes constitutes a contraindication.

Administration.—In administering anesthetics the following precautions should be taken:

The stomach of the patient should contain no food.

The clothing should be loose about the neck, thorax, and abdomen, allowing perfect freedom of respiration.

Artificial teeth should be removed.

It should be remembered that ether is inflammable, and, when its vapor is mixed with air, explosive; it should, therefore, not be used near a flame or an actual cautery, from which it may ignite.

The patient should be kept covered, in order that there may not be too great a reduction in temperature. He should, moreover, be watched for several hours after the administration, since there is always more or less danger until the effects of the ether have entirely disappeared.

Under proper methods the administration of ether occasions little inconvenience. In addition to the recommendations already given, it may be added that smearing the mouth and nose with oil prevents the excoriation frequently occasioned by contact with the anesthetic.

There are various means of administration, the simplest and in many cases the most efficient being a towel shaped into a funnel or hollow cone, with a piece of stiff paper laid between the outer folds to preserve the shape. Many other mechanical contrivances are in use. The Allys inhaler is widely used, although the tendency is to use more complicated inhalers.

In using the towel-cone the inner surface is saturated with about half an ounce of ether, the inhaler at first not being placed close to the mouth and nose, thus allowing the vapor to be sufficiently diluted with air. The effect of this method is to accustom the air-passages to the primary irritation of the anesthetic and graduate its effects. It should be borne in mind that poisoning occurs in both ether and chloroform anesthetics by reason of too concentrated a vapor. Ether should not be administered in more than 6-10 per cent. of vapor. Chloroform vapor should be much more diluted—1-2 per cent. After this the towel may be pressed closer to the mouth and nose and the vapor of ether freely administered. In this manner a person may become completely etherized without nausea or resistance. The insensibility of the conjunctiva and complete relaxation of the muscles, accompanied by semi-stertorous breathing, indicate that the stage of desirable anesthesia is attained. The quantity of ether administered should now be reduced, further supplies being limited to the amount requisite to maintain complete anesthesia.

The symptoms incident to the primary effects of etherization—cerebral excitement, muscular activity, etc.—should not induce withdrawal of the anesthetic, but rather its continuance. Should vomiting occur at this stage, etherization should be suspended and the mouth thoroughly cleansed by means of a sponge or a towel.

Complete loss of consciousness marks the following stage of anesthesia, when total relaxation supervenes, accompanied by gentle, regular breathing. Should stertorous respiration attend further

etherization, it is a warning of paresis, and the drug should be withdrawn.

Congestion of the facial muscles during anesthesia is quite normal, pallor, as a rule, indicating cardiac or respiratory debility. The practice of closely covering the face is thus to be discouraged, since it conceals important symptoms of the patient's physiological condition. The danger from asphyxia in complete etherization is shown by the entire muscular relaxation of the tongue, which is prone to drop backward, and the closing of the glottis, suspending respiration. In such an occurrence the jaw should be pressed forward, the head being well extended, and, if necessary, the tongue brought forward with the forceps.

The pulse, respiration, color, and pupillary reflex are the main points under observation by the anesthetist. At first the rate of the pulse is usually increased by reason of excitement; later it becomes slower and fuller, and when it becomes very slow and feeble, it is wise to ease the patient. The respirations, after the preliminary choking and gagging, become full, deep, and slower. As anesthesia progresses they become shallower and shallower, and should always be watched with a critical eye, especially if cyanosis develops. This indicates the danger-limit to which etherization may proceed. The pupils exhibit a variety of changes and differ in every individual. The usual rule is to have a preliminary dilatation, and during narcosis a moderate state of contraction. If marked dilatation occurs in deep narcosis, this is an indication of poisoning and for the withdrawal of the anesthetic.

Under favorable conditions, from five to twelve minutes are required to etherize the patient completely. The effects of anesthesia upon recovery vary with the temperament and character of the individual and the conditions under which the drug is administered. Great excitability may attend awakening from etherization, or the patient may return to consciousness as from a tranquil slumber. Nausea and vomiting frequently accompany rallying from the narcosis—not, however, such as may require especial treatment. Should somnolence be manifested, it is best not to rouse the patient, that the awakening may be easy and natural.

In etherizing a female patient the presence of a woman is always desirable, in order that her testimony may assuage certain sexual impressions to which women during anesthesia are prone. To the operator and attendants her presence is also of importance.

In collapse states hot applications, the internal administration by hypodermic of caffeine, strychnine, ergot, or adrenalin chloride are each, and may be all, called for. Artificial respiration is imperative, oxygen often helpful, and enteroclysis with hot saline, or infusion may be useful. Suprarenal extracts may be of service.

Great care should be taken to see that the patient is well covered and not exposed to drafts, in its relaxed condition the body being peculiarly susceptible to pneumonia or pleurisy. The anes-

thetic should be carefully examined before administration, and the character of the drug thoroughly known.

Chloroformum—Chloroformi—Chloroform. U. S. P.

Definition.—A liquid consisting of from 99 to 99.4 per cent., by weight, of absolute chloroform, and from 0.6 to 1 per cent. of alcohol.

Description and Properties.—A heavy, clear, colorless, mobile, and diffusible liquid, of a characteristic ethereal odor and a burning taste. Specific gravity, not below 1.475. Soluble in about 200 times its volume of cold water, and in all proportions in alcohol, ether, benzene, petroleum benzene, and fixed and volatile oils.

Chloroform is volatile, even at a low temperature, and boils at 60° to 61° C. (140° – 141.8° F.). It is not inflammable, but its heated vapor burns, emitting a green flame. It should be kept in dark, amber-colored, glass-stoppered bottles, in a cool and dark place.

Dose, 2–15 minims (0.12–1.0 Cc.) [5 minims (0.3 Cc.), U. S. P.].

Official Preparations.

Aqua Chloroformi—Aque Chloroformi—Chloroform Water.—*Dose,* 1–4 fluidrachms (4–16 Cc.).

Emulsio Chloroformi—Emulsi Chloroformi—Chloroform Emulsion.—*Dose,* 1–4 fluidrachms (4–16 Cc.).

Linimentum Chloroformi—Linimenti Chloroformi—Chloroform Liniment.—*For external use.* Chloroform, 30, soap liniment, 70 parts.

Spiritus Chloroformi—Spiritus Chloroformi—Spirit of Chloroform.—*Dose,* 10 minims–1 fluidrachm (0.6–4 Cc.).

Antagonists and Incompatibles.—Chloroform will not mix with weak spirits or glycerin. Circulatory and respiratory stimulants and galvanism antagonize to some extent its poisonous action. There is no chemical antidote.

Synergists.—Anesthetics, alcohol, morphine, chloral, and many of the hypnotics.

Physiological Action.—*Externally and Locally.*—Its action is similar to that of ether, though when confined on the skin it produces vesication. It is more of an irritant to mucous membranes than ether, yet when inhaled it is less irritating to the respiratory tract.

Internally.—Digestive System.—Its action upon the digestive tract is nearly identical with that of ether, except that when taken in a concentrated form it occasions marked irritation of the stomach and intestines, often resulting in violent gastro-enteritis.

Circulatory System.—Chloroform depresses the heart and circulation, the former by weakening the cardiac muscle, and the latter by lowering arterial pressure by depressing the vaso-motor center. It frequently produces an intermittent pulse by stimulating the inhibitory ganglia of the heart.

Nervous System.—It affects the brain and spinal cord in the same manner and order as ether, like it producing death, usually by respiratory failure, though sometimes the heart first succumbs to the influence of the drug.

Respiratory System.—Its action closely resembles that of ether, though its operation is more rapid and powerful.

Absorption and Elimination.—Chloroform affects the kidneys by

irritation, certain investigators claiming that acute nephritis ensues, blood and albumin being often present; it is certainly less irritating than ether.

Temperature.—It depresses the temperature.

Untoward Action.—If there be any marked idiosyncrasy against chloroform, death has been known to occur suddenly after a few inhalations of the drug.

When applied externally there is produced not infrequently an urticaria-like eruption or an eczematous condition of the skin; vesicles may result. If applied to sensitive portions of the skin, such as the scrotum, severe and persistent pain is sometimes occasioned. Frequently, when applied to wounds and mucous membranes, it causes intense irritation, so much so that the mucous membrane may be shed in pieces.

The symptomatic manifestations of chloroform-anesthesia, the methods of administration, and the treatment of chloroform accidents are in the main similar in general principle to ether, and will be considered only in so far as certain differences are concerned.

The appliances used in producing anesthesia by the aid of chloroform are various, the simplest, as in the administration of ether, being a cone formed of a napkin or a towel enclosing a sponge or not, a sponge alone, or a handkerchief, upon which a small quantity of chloroform—not exceeding from a half to one fluid-drachm (20-40 Cc.) at a time—is poured. The utmost vigilance is requisite in the administration, the respiration, pulse, and facial indications being constantly observed; a supply of air is allowed to mingle with the anesthetic to obviate the dangerous effect of its concentrated vapor. The drug should be instantly withdrawn upon the slightest indication of untoward symptoms, such as lividity of the face, debility of heart-pulsation, and stertorous or spasmodic respiration, and an ominous dilatation of the pupils.

Although the symptomatic features of chloroform-narcosis, especially those which accompany collapse and death, have been studiously examined, the conditions causing disaster are still but imperfectly understood. Nevertheless, premonitory indications are seldom wanting which mark clearly enough the limit of safety in administration. Of these, extreme mydriasis and failure to produce reflex action in the conjunctiva are alone symptoms to be regarded with the gravest apprehension.

Relative Safety.—Comparisons as to the relative safety of ether and chloroform are misleading. Statistics pointing in both directions have been compiled, and certain surgeons have distinct biases. It would appear that more untoward accidents occur under chloroform-anesthesia than under ether, and a fair estimate may be made of 1 death in 2500-3000 anesthetizations, while for ether observations of numerous surgical services show an average of 1 in 10,000-15,000. Gurlt's statistics on over 300,000 anesthetics resulted in 1 in 2000 for chloroform to 1 in 5000 in ether.

*Some Points of Difference in Ether and Chloroform.**Ether.*—Not in tropics because of low boiling point.

Avoid flame.

Large bulk. Army work.

Local anesthetic. Cooling.

Irritant to glottis.

Longer time. More excitement.

Larger quantity. 6 per cent. vapor.

Somewhat safer.

Irritant to kidneys.

Chloroform.—Tropics.

Not readily ignited

Small bulk. Army work.

Not adapted. Irritant

Non-irritating. Children.

Bronchitis.

Shorter time. Less excitement.

Small amounts. 1 per cent. vapor

Accidents more liable

Also irritant. Thought to be less

The comparative value of ether and chloroform may be summarized as follows :

1. If an anesthetic be required, ether is preferable in the case of a patient suffering from a weak cardiac action or an organic disease of the heart.

2. For operations about the face or of the stomach, as there is less danger of reflex inhibition of the heart, ether is preferable to chloroform.

3. Ether is preferable as an anesthetic in the extraction of teeth, chloroform being more apt to cause cardiac paralysis, reflexly by way of the dental nerve to the root of the vagus, and through the vagus to the inhibitory ganglia of the heart-muscle.

4. Ordinarily, ether is superior to and safer than chloroform as an anesthetic for adults unless some special contraindication exists, there being less danger in ether of cardiac failure, to which adults are more liable.

The use of chloroform is more desirable under certain conditions, thus :

1. Obstetrics, since the use of it is attended with less depression and irritation of the respiration and respiratory tract. Moreover, chloroform produces less nausea and vomiting, and may be administered by the patient herself under proper directions.

2. It is preferable in anesthetizing children, being more rapid in its action and less potent as a respiratory depressant, the respiratory center of the child being more susceptible than that of the adult, and in children the danger of cardiac paralysis being slight.

3. Should the patient be suffering from nephritis, chloroform is preferable as an anesthetic, since it is less irritating to the kidneys.

4. Should an anesthetic be required for patients afflicted with pulmonary tuberculosis, empyema, or other disease of the lungs, chloroform should be used, since its effect upon the respiratory system is less depressing.

5. It is preferable in very hot climates, as ether boils at 37° C. (98.6° F.).

Æthylis Chlōridum—Æthylis Chlōridi—Ethyl Chloride. U. S. P.

Definition.—A haloid derivative prepared by the action of hydrochloric acid gas upon absolute ethyl alcohol. It is also known as *Arlene* or *keline*.

Description.—A colorless, mobile, very volatile liquid, having a characteristic, rather agreeable odor and a burning taste. It boils at a temperature of 12.5° to 13° C. It is slightly soluble in water, readily in alcohol. It is very inflammable and should not be used in proximity to a gas flame or fire.

A volatile, colorless, and inflammable liquid, having a pleasant odor. It is a very fugacious anesthetic, greatly depressing the heart and respiration, and is mainly used in the form of a spray, to produce local anesthesia. Caution should be observed in operations about the head, as freezing of the cornea is apt to leave residual opacities.

ADDITIONAL ANESTHETICS AND THEIR COMPARATIVE VALUE.

Ethyl Bromide.—A colorless, inflammable liquid, with a burning taste and an odor like that of chloroform. It is readily decomposed, with evolution of bromide. Its action is uncertain, causing great irritation of the respiratory passages, and usually producing death by paralysis of respiration.

Ethyl Iodide.—A liquid anesthetic, similar in its physiological action to chloroform. Anesthesia produced by it, however, is more tardy, although more permanent. It is considered a comparatively safe and efficient anesthetic to relieve spasm of the respiratory passages, as in asthma and laryngitis.

Ethylene Bichloride.—More rapid and powerful in its action than chloroform, though not so safe, affecting the respiratory center invariably before influencing the heart. While speedier in its action than ether, it is probably more dangerous.

Ethylene Bromide.—A weak yet dangerous anesthetic, greatly depressing the respiratory center, and tending to cause paralysis of the extremities and stoppage of the heart.

Ethylene Iodide.—A crystalline substance, its fumes when heated producing anesthesia, with great irritation of the respiratory passages, and death by asphyxia.

Ethylidene Chloride.—A non-inflammable liquid resembling chloroform in its physical appearance, and in its physiological action as well, although much less depressant to the heart. It causes more irritation to the respiratory passages, with vomiting and great languor and discomfort as its sequelæ.

Methyl Chloride.—A colorless, inflammable gas, with a taste and odor resembling those of ether and chloroform. Cold liquefies it. It is used locally to produce anesthesia and to relieve pain in neuralgia.

Methylene Bichloride.—A colorless liquid, its odor being like that of chloroform. Exposure to the light decomposes it. Anesthesia produced by this agent is accompanied with comparatively little irritation of the respiratory tract, but it occasions a primary

stage of excitement like that induced by ether, and, as in the case of chloroform administration, vomiting is likely to ensue. Death takes place from paralysis of the heart. The numerous fatalities which have occurred under this anesthetic indicate the danger of its use, and its volatility renders its employment difficult in a hot atmosphere.

Carbon Tetrachloride—Tetrachlormethane.—A transparent, colorless liquid, of an agreeable aromatic flavor, analogous in its action to chloroform, but less irritating, although far more dangerous to the heart.

Formic Ether.—A thin, colorless, inflammable liquid, of strong, agreeable odor and pungent taste. It acts like chloroform, though the signs of asphyxia are less marked. Its effects last for several hours.

Methylic Ether.—A colorless, inflammable gas, heavier than air, of an ethereal odor and aromatic taste. Richardson considers it a safe anesthetic, though objectionable because of its odor—less agreeable than those of ether and chloroform—and the rapidity with which it volatilizes from its solution.

Methylal—Methylene—Dimethyl Ether.—A highly volatile, colorless, limpid liquid, of penetrating ethereal odor. It is used chiefly as a local anesthetic and as an efficient hypnotic in insanity and delirium tremens.

Acetic Ether (U. S. P.).—A colorless, limpid, volatile liquid having an agreeable, refreshing, ethereal, and somewhat acetous odor and taste. It has the advantage over sulphuric ether of being less inflammable and less volatile. Owing to its pungent and agreeable odor, too, it is superior to the latter drug in stimulating the nasal passages in cases of syncope and nervous agitation.

Pental.—A colorless, volatile, inflammable liquid, insoluble in water, but miscible in all proportions with alcohol, ether, and chloroform. It has a mustard-like odor, and is comparatively free from danger. When poisonous amounts are administered the pulse is quickened, the respiration embarrassed, and death ensues from paralysis of the heart. It resembles chloroform rather than ether, but is less irritating and seldom accompanied with unpleasant after-effects. It requires but about 5 drachms (200 Cc.) to produce anesthesia, which occurs in from two to three minutes.

There is a difference of opinion as to the safety of pental, some physicians considering it less dangerous than chloroform, and others regarding it as less efficient and not so safe.

Nitrous Oxide ("Laughing Gas").—A colorless gas, of a very slight, agreeable odor and sweetish taste. It is not inflammable, but supports combustion of ignited bodies. Pressure and cold condense it into either a thin, colorless, very mobile liquid or colorless crystals. It is a rapid anesthetic, unconsciousness being produced in from one-half a minute to three minutes. The pulse is strong and quick, the respirations frequent and shallow, while, as the inhalation continues, the breathing becomes stertorous and the face

is cyanotic. If the inhalation be interrupted or the gas mixed with air, symptoms of intoxication are manifested, accompanied with a high degree of mental excitement. It is a very safe anesthetic, but the anesthesia is of quite short duration, rendering it valuable mainly for the extraction of teeth and in minor surgery.

HYPNOTICS.

The term hypnotics has been applied to a group of substances capable of inducing sleep. A large number of these hypnotics are members of the methane series, or close derivatives. Their hypnotic action is directly comparable with that of alcohol, ether, or chloroform, but, by reason of the addition to the methane radical of different substances, other physiological actions may ensue which may modify to some extent the action of the primary substance.

As already intimated, practically the only alcohol used as a hypnotic is amylene hydrate. Its action resembles that of alcohol, but it induces narcosis more rapidly with smaller doses.

Amylene Hydrate.

A tertiary alcohol, the chemical name being *dimethylethylcarbinol*.

Description and Properties.—It occurs as a limpid, colorless, neutral fluid, of a peculiar odor and burning taste. It is soluble in 8 parts of water, and miscible in all proportions with alcohol, chloroform, benzoin, glycerin, and fixed oils.

Dose.—1-2 fluidrachms (4 0-8 0 Cc.)

Therapeutics.—Amylene hydrate is a useful hypnotic, intermediate in strength between paraldehyde and chloral. It is pleasanter to take than either. Many observers consider it to be safer than chloral, while its soporific effects are produced sooner, being manifested usually in from five to thirty minutes, the awakening being ordinarily prompt and complete. Amylene hydrate is best given in a mixture of wine and syrup of liquorice; if administered by rectum, it should be suspended in mucilage.

Of the ethers, other than ethyl ether, *methylal* and *acetal* have both been tried. They have both been found to depress the heart action. Methylal is very rapidly eliminated, and the hypnosis induced is of very short duration. It is given in doses of 8-15 grains (0 5-1 0 Gm.), and is also useful as a carminative.

The esters that have been shown to be serviceable as hypnotics are urethane, hedonal, and veronal.

Æthylis Carbāmas—Æthylis Carbāmatis—Ethyl Carbamate—Urethane. *U. S. P.*

Definition.—An ester of carbamic acid, $\text{CO} \begin{smallmatrix} \text{NH}_2 \\ \diagup \\ \text{OC}_2\text{H}_5 \end{smallmatrix}$, obtained by the reaction of ethyl alcohol upon urea (carbamide) or one of its salts. Reaction: $\text{CO} \begin{smallmatrix} \text{NH}_2 \\ \diagup \\ \text{NH}_2 \end{smallmatrix} + \text{HOC}_2\text{H}_5 = \text{CO} \begin{smallmatrix} \text{NH}_2 \\ \diagup \\ \text{OC}_2\text{H}_5 \end{smallmatrix} + \text{NH}_3$.

Description and Properties.—It occurs as colorless, odorless, columnar, or tabular crystals, having a pleasant, cooling, and saline taste, somewhat resembling that of saltpetre. It is soluble in about 1 part of water, and in like proportion in ether and chloroform, in 0.6 part of alcohol, 0.8 part of liquefied carbonic acid, 3 parts of glycenn, 15 parts of castor oil, and 20 parts of olive oil.

Dose.—10–45 grains (0.6–3.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Its physiological action resembles others of the alcohol narcotics. The presence of (NH_2) groups prevents an overaction as a hypnotic, and in large doses may even destroy its sleep-producing effects, causing stimulation as in ammonia. It is less depressing upon the circulation and respiration than chloral, but more so upon the peripheral ends of the motor nerves. Acting directly upon the cerebrum, it produces a refreshing and dreamless sleep, with no unpleasant after-effects. Nevertheless, it is not so reliable a hypnotic as chloral, and its usefulness as a therapeutic agent is still a debatable question, probably no hypnotic having been introduced concerning the effects of which there is such diversity of opinion. It may be given in capsules or in some pleasant water or syrup, and may also be conveniently administered as an injection by the rectum.

Hedonal.

Methyl-propyl-carbinol urethane, $\text{CO} < \begin{smallmatrix} \text{NH}_2 \\ \text{O} \end{smallmatrix} \text{—CH—CH}_2$.

Properties.—A white crystalline powder insoluble in cold water, slightly soluble in warm water. Soluble in alcohol.

Dose.—From 15–45 grains (1–3 Gm.), best given dry on the tongue, washed down, or in a capsule or cachet.

Therapeutics.—A useful hypnotic but not powerful, closely related to ethyl carbamate. Valuable in the insomnia of neurasthenia. It is markedly diuretic and hence may be useful in the insomnia of Bright's disease with diminished secretion. Large doses have been known to cause depression.

Véronal.

A related product. Diethyl malonyl urea, $\text{C}(\text{C}_2\text{H}_5)_2\text{CO}(\text{CONH})_2$.

Proportions.—A white crystalline powder, soluble in 145 parts of cold water and 12 parts of boiling water. Slightly bitterish taste.

Dose.—8–15 grains (0.5–1 Gm.).

Therapeutics.—A valuable hypnotic of marked action and little after-effects in small doses, save some mild headache. Following large doses, considerable dizziness, and even delirium has been observed. Tolerance does not seem to be readily established. It is valuable in the insomnia of hemorrhage following childbirth, and is useful in mild maniacal excitement. The reports thus far published seem to indicate that it is reliable and safe if given in doses not to exceed 10 or 15 grains (0.6–1 Gm.).

Of the *aldehydes* paraldehyde is the oldest and best known. With the vast accession of new and reliable hypnotics there is little occasion to give this disagreeable substance. It is safe, however.

Sulphonal, trional, and tetronal are three newer hypnotics of this general chemical group. They are sulphon, methane hydrocarbons synthetized with sulphur.

Paraldehydum—Paraldehydi—Paraldehyde.

U. S. P.

Origin.—A polymer of acetaldehyde [CH_3COH].

Description and Properties. A colorless, transparent liquid, having a strong, characteristic, but not unpleasant, pungent odor, somewhat resembling that of chloroform, and a burning, cooling taste. Soluble in 8 parts of water at 25°C (77°F) and in 16 $\frac{1}{2}$ parts of hot water, being, as will be observed, more soluble in the former than in the latter. Miscible in all proportions with alcohol, ether, and fixed and volatile oils.

Dose.— $\frac{1}{2}$ –1 fluidrachm (1.0–4.0 Cc) [30 minims (2 Cc), *U. S. P.*].

Physiological Action.—*Externally and Locally*—Antiseptic, antifermentative. In general its action is like that of alcohol.

Internally.—Digestive System.—Paraldehyde has little action upon the digestive tract. It may cause indigestion.

Circulatory System.—It differs from chloral in affecting the circulatory system favorably in medicinal doses, tending rather to slow and strengthen the pulse. Toxic doses weaken the heart and lower arterial pressure, the heart's action ceasing in diastole.

Nervous System.—Its influence upon the brain and spinal cord is similar to that of chloral. The sleep it induces, however, is not so prolonged as that caused by the latter drug, more frequent doses being required for continued soporific effects. The sequelæ of paraldehyde are not unpleasant.

Respiratory System.—Its action resembles that of alcohol, although it is not so powerful a respiratory depressant as the halogen derivatives of alcohol. In toxic doses death usually ensues from paralysis of the respiratory center.

Absorption and Elimination.—Paraldehyde is eliminated by the lungs and kidneys, the excretion of nitrogen and phosphorus being somewhat lessened.

Temperature.—Like alcohol, it lowers the temperature, but in less degree.

Uterine Action.—It occasionally causes irritation of the mucous membranes and erythematous eruptions.

Poisoning.—The symptoms of poisoning are similar to those of chloral. Fatty degeneration of the heart and liver have been found, together with disorganization of the red corpuscles.

Treatment of Poisoning.—The same as in poisoning from chloral.

Therapeutics.—Like those of chloral. Paraldehyde is more hypnotic than anodyne, appearing to be best adapted to relieve so-called *idiopathic insomnia*. It is a better diuretic than chloral, and in certain degenerated conditions of the heart and arteries, where a diuretic as well as hypnotic is desirable, paraldehyde serves as a valuable remedy.

Administration.—It may be given in capsules, or, when other-

wise administered, its unpleasant taste may be disguised by giving it in an emulsion flavored with orange or bitter almond. Glycerin also renders it quite palatable, yet it is always more disagreeable to the taste than chloral, besides lending to the breath an offensive and persistent odor.

SULPHUR DERIVATIVES OF ALCOHOL.

In a series of experiments on the feeding of animals with sulphur compounds with reference to the formation of fat, Baumann and Kast found that several of the products caused sleep, and they investigated the whole series of sulphones. Disulphon itself they found inactive, and a large number of the simpler members of the group were found to be inactive because they were not broken up by the body. In those sulphones, however, with a large number of methyl or ethyl groups, they found marked oxidation in the body with a strong hypnotic action. Sulphonal (diethylsulphondimethylmethane), trional (diethylsulphonmethylethylmethane), and tetronal (diethylsulphondimethylmethane) they found were the best of these, and they have been introduced into therapeutics with success.

Sulphonmëthanum—Sulphonmëthane—Sulphonal.

U. S. P.

This substance, diethylsulphondimethylmethane, $\text{CH}_3\text{CH}_2\text{SO}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{CH}_3$ is the product of the oxidation of the mercaptol obtained by the condensation of acetone with ethylmercaptan.

Description and Properties.—It occurs as colorless, odorless, nearly tasteless prismatic crystals, soluble in 300 parts of cold water, in 15 parts of boiling water, and in 65 parts of cold or 2 parts of boiling alcohol. It is a very stable substance, being unaffected by concentrated acids or alkalis.

Dose.—15–30 grains (1.0–2.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Antagonists and Incompatibles.—There are none of importance.

Synergists.—Morphine and conium intensify its hypnotic action.

Circulatory System.—It has no depressing action on the heart; on the contrary, it slightly accelerates the pulse by depressing the inhibitory center.

Nervous System.—Like chloral, it depresses the cerebral cortex, but has less influence on the motor and sensory nerves. Its soporific action is very much slower than that of chloral, requiring from three to eight hours to produce sleep, which averages about seven hours.

Respiratory System.—In medicinal doses it is much less depressing to the respiratory center than chloral.

Physiological Action.—*Externally and locally*, sulphonal has no influence.

Internally.—**Digestive System.**—In medicinal doses it has no effect on the digestive tract. Toxic doses may result in nausea, vomiting, and gastric pain.

Its action on the nervous system, on the circulation, and on respiration is like that of alcohol. The sulphonal radicals do not seem to enter into the cerebral action to any great extent.

Absorption and Elimination.—Being relatively insoluble, its absorption is slow, usually requiring several hours to exert its hypnotic action. It seems to be broken up in the body, only traces being eliminated unchanged. Traces of methylene and diethylene sulphonic acid appear in the urine. The sulphates of the urine have been said to be increased under its continued use, and in its passage through the blood it exerts a marked action on the red blood-cells, giving rise to a peculiar type of poisoning.

The upward action and poisoning resulting from the use of sulphonal present symptoms of so varied a character that the drug seems to possess no properties of a uniformly toxic nature. Moreover, in the cases of poisoning recorded the condition of the patient and the quality of the drug have been such as to require considerable variation in the amount given. In one case 30 grains (2.0 Gm.) produced death in forty hours (*Med. News*, lv., p. 166.); while in another a man swallowed 3 ounces (96.0 Gm.) of sulphonal, which, although resulting in a condition of coma lasting six days, terminated in recovery (*Jour. Amer. Med. Assn.*, iv., p. 21).

In general, however, the poisonous effects of sulphonal are exerted on the blood and on the nervous system. When large doses are taken unconsciousness, which may persist for long intervals, is the most prominent symptom. Paralysis, but rarely convulsions, have been noted. Respiration is at first unaltered, but later may become stertorous, shallow, and slow. Cyanosis develops; the pulse is small and irregular. A preliminary fall of temperature is followed by a rise, perhaps to 40 C. (104 F.). The kidneys may or may not be affected. There may be constipation, or, if paralysis of the intestinal musculature has occurred, a diarrhea may supervene. **Papular exanthemata are not uncommon.**

In individuals who may be taking any of this type of hypnotics for any considerable period of time irregular toxic symptoms are noted. These consist for the most part of hebetude, sleepiness, stupidity, loss of appetite, and muscular weakness; the frequency of the pulse is diminished, and if the poisoning is more pronounced, there may be dizziness, ataxia, and, rarely, hallucinations and delirium. The most important symptom is the presence of hematuria, produced by the breaking up of the blood-pigment in the red corpuscles and its appearance in the urine as hematurin, a reduction product of hemoglobin. This gives this fluid a peculiar cherry-red color. Its appearance is a signal to cease the use of the drug.

Of the three drugs of this class, trional is perhaps to be preferred. Tetronal is not to be recommended. Very persistent habits may be contracted by takers of these drugs.

Treatment of Poisoning—Discontinuance of the drug; eliminative and symptomatic treatment.

Therapeutics.—Sulphonal is never used *externally*, and *internally* it is chiefly valuable as a hypnotic—in insomnia unaccompanied by pain, and particularly to produce sleep and quiet the intense *excitement of the insane*. When insomnia is accompanied by considerable motor restlessness, combinations of sulphonal, of trional, or of veronal with old vegetable narcotics, like hyoscyamus, conium, etc., are frequently beneficial to produce sleep and quiet the motor disturbance. The following is an excellent formula:

R	Sulphonal,	gr xvij (1.12 Gm.);
	Flu. extracti conii,	M xvij (1.12 Gm.).
	℞ caps. No VI	

Sig. Take two at 6 P. M., two at 8 P. M., and two at 10 P. M. The next night half this quantity will probably suffice.

The author has used this prescription with good results in *cough* and *nocturnal cramps*. It should prove efficacious in other spasmodic affections, such as *chorea*, *epilepsy*, and the *spasm of fractures*. Sulphonal has been recommended as a sexual sedative in *chordee* and *spermatorrhea*, and as a useful remedy in *colliquative night-sweats*. When used for a long time, it has a deleterious action on the heart, and should not be employed in cases of insomnia from cardiac disease.

Sulphonal is of no value in insomnia due to pain.

Wood recommends the drug as an intestinal antiseptic when given an hour after meals.

Administration.—Sulphonal should be given in powder or capsules or in hot whiskey. Owing to its insolubility, it should not be administered in the form of compressed tablets.

Sulphonethylmethanum — Sulphonethylmethane — Trional. U. S. P.

Diethylsulphonmethylmethane, $(CH_3)(C_2H_5)C(SO_2C_2H_5)_2$, a product of the oxidation of mercaptol, obtained by the condensation of methyl ethyl ketone with ethyl-mercaptan.

Description.—It occurs in colorless, lustrous, odorless, crystalline scales which have a bitter taste in aqueous solution. Trional is soluble in 105 parts of water, more readily in boiling water, and readily soluble in alcohol and ether. It melts at $76^\circ C.$; hence if a test tube containing some of the powder be placed in hot water, the substance will melt, sulphonmethinum sulphonal, the melting point of which is $125.5^\circ C.$ will not melt under these circumstances.

Dose.—Average dose, 15 grains (1 Gm.), U. S. P.

Therapeutics.—By reason of its greater solubility its action is more rapid than that of sulphonal. Identical symptoms of poisoning as those of sulphonal have been noted, but breaking down more rapidly and being eliminated much faster, the tendency to cumulative action and to blood-destruction seems less than with its ally sulphonal. In combination they are useful hypnotics.

Tetronal (Diethyl-sulphon-diethyl-methane) — Origin.—This substance is also prepared like sulphonal.

Description and Properties.—Colorless, shining plates and laminae, of bitter taste and slightly camphoraceous odor; soluble in 450 parts of cold and in 5 parts of boiling alcohol; insoluble in water.

Dose.—10–40 grains (0.6–2.5 Gm.).

Therapeutics.—Tetronal seems to be more poisonous than either of the others of the group. Why this should be so is not yet established. Like sulphonal, however, it breaks down slowly, and a cumulative action may account for its greater toxicity.

HALOGEN DERIVATIVES OF ALCOHOL.

A large and important series of hypnotics are classed in this group. Chloral, the point of departure of the others, has been in use for a number of years, and in the attempt to produce a similar body free from the disagreeable taste and from some of the more depressing cardiac action, a host of alcohol halogens has been made and introduced into therapeutics.

The introduction of chlorine into the hydrocarbon series produces a more marked change in the action than has been noted for many of the alcoholic derivatives already discussed.

Ordinary marsh gas, CH_4 , has a very slight narcotic action. CH_3Cl is stronger, CH_2Cl_2 still stronger, CHCl_3 (chloroform) very active, and CCl_4 very highly toxic. A gradual increase in toxicity has been observed with the addition of chlorine atoms. In the same manner aldehyde is a mild narcotic, trichloraldehyde much more powerful. A large number of these compounds have been employed in anesthesia; these have already been discussed.

For the most part the newer chloral substitutes are known to break down into chloral in the metabolism of the body. On general principles, therefore, it is difficult to see wherein they are to offer any marked advantages over the parent body itself. If, however, the compound with which it is combined is so split off in the body and is then so unmodified as to be active and to be able to overcome the untoward effects of the chloral or its reduction compounds, a useful hypnotic must be the result. Up to the present time it does not appear from other sources than those with a commercial bias that this very desirable combination has been found. There is no reason to believe that it may not be accomplished, but nearly all the theoretically possible combinations have been made and tried. A number of the compounds now manufactured are useful nevertheless, and will be here considered.

Chlorālum Hydrātum—Chlorāli Hydrāti—Hydrated Chloral. *U. S. P.*

Definition.—A crystalline solid composed of trichloraldehyde or chloral [$\text{C}_2\text{H}_3\text{Cl}_3$, (2H)] (an unstable, oily, and colorless fluid) with 1 molecule of water, forming the *hydrate of chloral*, the official preparation, and the only one used in medicine. Chloral itself is prepared by the action of chlorine upon alcohol, whence the name *chloral*.

Description and Properties.—Chloral hydrate occurs as separate, rhomboidal, colorless, transparent crystals, having an aromatic penetrating, and slightly menthol-like, and a bitterish, caustic taste. It is slightly volatilized when exposed to the air, and is freely soluble in water, alcohol, and ether, being also soluble in chloroform, benzol, benzine, carbon disulphide, and fixed and volatile oils. It liquefies when triturated with an equal quantity of camphor, menthol, thymol, or phenol.

Dose—5–20 grains (0.3–1.2 Gm.) [1 Gm.—15 gr., *U. S. P.*].

Antagonists and Incompatibles.—Chloral is incompatible with all alkalis, and calcic hydrate converts it into formate of calcium and chloroform. Strychnine, atropine, and external heat are antagonistic.

Synergists.—All the hypnotics favor its characteristic property of producing sleep. Morphine enhances its hypnotic effects, while lessening its depressing influence upon the heart.

Physiological Action.—*Externally and Locally.*—Chloral is germicidal, antiseptic, anesthetic, and vesicant. It produces redness and sometimes vesication when applied to the unbroken skin, and when strong solutions are brought in contact with the derma or with wounds they may even occasion sloughing, and in healthy mucous membranes excite much pain. When introduced into the system hypodermically, chloral is apt to occasion gangrenous inflammation.

Internally.—**Digestive System.**—Small doses are slightly sedative to the stomach, though causing a sense of burning in the throat and exciting more or less salivation. Large doses sometimes produce nausea, vomiting, and purging. The pancreatic and biliary secretions are probably slightly increased.

Circulatory System.—Full medicinal doses may at first accelerate the pulse, which soon, however, becomes slower, weaker, and softer. Under toxic doses the heart's action may be weak, rapid, and irregular, when death ensues, the heart being arrested in diastole.

A primary effect of chloral is to lower arterial tension by its depressant action upon the heart through its nervous mechanism. It acts similarly upon the vasomotor center and upon the structures in the arteriole wall, dilating the blood-vessels.

In its depressing action on the heart chloral is more pronounced than in other non-chlorinated members of the alcohol group. It is highly probable that the presence of chlorine is an important factor in this added toxic action in the circulation.

Nervous System.—Medicinal doses sometimes occasion a preliminary stage of cerebral excitement, due probably to a temporary stimulation of the circulation and possibly transitory cortical irritation. This is soon followed—usually in from fifteen to thirty minutes—by a sound, dreamless slumber, induced by a direct depression of the cortical cells of the brain. The sleep thus produced closely resembles that of physiological slumber. It usually persists for from seven to eight hours, when the patient awakes refreshed and usually without *malaise* or digestive disturbance.

The action on the spinal cord is one of depression, as in alcohol. The actions on the special senses resemble those of chloroform.

Respiratory System.—In full doses chloral is a respiratory depressant, rendering the breathing slower and weaker, while under toxic doses it may cease altogether from paralysis of the respiratory center.

Absorption and Elimination.—Chloral is quite rapidly absorbed, and is supposed to circulate in the blood in its original state. It is

eliminated by the lungs and skin, but chiefly by the kidneys, where it reappears as urochloranic acid, which consists of trichlorethyl alcohol combined with glycuronic acid, although when an excessive amount of the drug has been taken it may be found in the urine unchanged. It usually increases the flow of urine, and reduces Fehling's solution. The presence of chloral derivatives should, therefore, always be thought of in testing for sugar.

Metabolism.—Chloral behaves in large part as chloroform on metabolism. It leads to increased proteid destruction and lessens cellular oxidative functions. It thus shows increased phosphates, nitrates, and sulphur, and by the suboxidations leads as from alcohol, to fatty degenerations. The diminution in muscular activity retards muscle metabolism, thus less oxygen is observed and less carbon dioxide is excreted. In large doses chloral exerts a destructive influence on the blood and also in blood-vessels.

Temperature.—Chloral is a decided antipyretic even in medicinal doses, while toxic doses produce a dangerous reduction of temperature. This action is doubtless owing to a diminution of heat-production because of diminished oxidation in the cells of the body and to an increase of heat-dissipation from the dilated cutaneous vessels.

Pup.—The continued use of chloral almost invariably results in a contracted pupil, unless psychic alterations supervene, when the pupillary contraction gives place to dilatation.

Untoward Action.—There may occur great anxiety; disturbances of respiration, such as spasmodic breathing and even asphyxia, together with disturbances of vision and swelling of the conjunctive. There may also be present edema of the epiglottis, icterus, and various cutaneous eruptions commonly designated as "chloral rash."

Poisoning.—Although one of the most powerful hypnotics known, extraordinary doses of chloral have failed to prove fatal, as many as 300 grains (30 Gm.) having been given without serious poisoning. Nevertheless, 10 grains (1.6 Gm.), an ordinary dose, has been followed by toxic effects, while 15 grains (1.0 Gm.) has produced death. In view of so uncertain a power, great care is requisite in the administration of this drug.

Lethal Poisoning.—The symptoms of poisoning from lethal doses are those of profound alcoholic narcosis plus the specific chlorine action. The patient is comatose. The pulse is feeble, thready, and irregular; the temperature is below normal; respiration is slow; the skin, particularly that of the forehead and extremities, may be covered with cold sweat and is pallid or cyanotic; the pupil is moderately contracted. There is great muscular relaxation, together with abolition of reflexes. Death is caused by paralysis of the respiratory center with pronounced cardiac weakness.

Autopsies have revealed inflammation of the mucosa of the mouth, esophagus, and stomach. In the latter organ ecchymoses may be present. Blood-changes are not constant but agglutina-

tion of the red blood-cells occur, and hyaline thromboses are present. Beginning fatty degeneration is also present in many of the organs, particularly the liver and kidneys.

Treatment of Poisoning.—It is of primary importance to maintain or restore the temperature by means of artificial heat—warm blankets, hot bottles, friction, massage, or other resources at command.

In order to arrest respiratory failure and stimulate the circulation, hypodermic injections of strychnine or atropine or the administration of other physiological antidotes, the inhalation of oxygen, and artificial respiration, may prove advantageous. Coffee as a hot rectal infusion is of value, and intravenous salt infusion may be demanded in severe cases. Naturally all alcoholic forms of stimulation are to be avoided.

Chronic Poisoning.—Chloral toxemia, or chloralism, is a well-recognized development of simple dosage.

The skin as in alcoholism may be subject to erythematous eruption, either persistent or temporarily excited by trivial causes. Respiration is embarrassed by the presence of dyspnea, which, however slight, is manifested after meals or is stimulated by physical exertion. Finally, the gravest complications may occur in the circulatory system, resulting in high fever, pyemia, and ultimate collapse.

The simplest treatment in these extreme cases is primarily the gradual withdrawal of the toxic agent, although delirium tremens is recorded as a result of abstinence. The diet should be carefully regulated with a view to restoring, if possible, the decreased vitality. Change of scene, abundant air and exercise, chalybeate tonics, calmatives, and nerve-stimulants undoubtedly contribute to re-establish functional activity and normal circulation, and occasional purgatives may assist in eliminating from the body the toxic elements which the pathological cells are constantly forming.

Therapeutics.—Externally and Locally.—An injection of a 10 per cent. solution of CHLORAL into the sac has been highly recommended by Marc Sée in the treatment of *hydrocele*. One ounce of this solution is injected, being followed in two or three days by a copious effusion, which is soon absorbed.

The antiseptic properties of chloral are utilized as a wash or dressing in *cancer of the uterus*, *foul ulcers*, etc. For these purposes the strength should be from 5 to 10 grains (0.3 to 0.6 Gm.) to 1 ounce (30.0 Cc.).

Spihn recommends the continued application of a solution of 1 drachm (4.0 Gm.) of chloral in 4 drachms (16.0 Cc.), each, of glycerin and water in cases of *furuncle*.

Bromidrosis and *hyperidrosis* have yielded to local applications of from 2 to 5 per cent. aqueous solutions of chloral.

CAMPHORATED CHLORAL is often an efficient remedy for *toothache*, and, when mixed with petrolatum or simple ointment in the proportion of 1 to 7, makes an excellent application in *pruritus* and

other itching diseases where the skin is unbroken. This preparation undiluted has been used in *neuralgia*, painted over the affected nerves.

Cregny employs a 20 per cent. solution of CHLORAL in *anal fissure*, and a 1 per cent. solution is used in *cracked nipples*.

Chloral is frequently used to preserve urine for microscopical examination, though it should not be added to urine reserved for chemical analysis intended to detect the supposed presence of sugar.

Solutions of chloral are used for embalming purposes and the preservation of anatomical specimens.

Internally—The principal use of CHLORAL internally is to depress the psychic mechanism and produce sleep. It is also employed to depress the reflexes and motor apparatus, and thereby diminish convulsions, and is sometimes useful in diminishing the activities of the sensory nerves.

As a hypnotic it is especially valuable in conditions characterized by excessive cerebral activity, such as *insomnia* resulting from overwork or worry, and in the wakefulness of many acute diseases—*typhoid*, *typhus*, and other *fevers*, *delirium tremens*, and *puerperal mania*—it is a remedy of well-known efficacy. Its depressing effects should always be guarded against during the active course of disease, as well as in *delirium tremens* where great cardiac weakness already exists. The insomnia of convalescence would usually indicate its use.

On account of its powerful depression upon the motor mechanism it is a valuable drug in treating the various *convulsions* and *spasmodic disorders of childhood*, such as *whooping cough*, *laryngismus stridulus*, *status epilepticus*, and *myoclonus*.

In *asthma*, *tetanus*, *uremic convulsions*, *hiccough*, *strychnine-poisoning*, and *hysteria* chloral has proved a useful remedy.

Chloral is useful in relieving the pains of *carcinoma* of the stomach, it is extremely valuable in restraining *chordee*, and in painful contractions of hollow viscera it is valuable, as in *colic*, in *gall-stone*, in *cystitis*, etc.

Certain forms of *epilepsy*, particularly the nocturnal variety, are benefited by this drug.

The reflex *vomiting in pregnancy* is sometimes relieved by either the internal administration of chloral or by enemias. It has also been used to depress the reflexes in *sea-sickness*.

It has given excellent results, used in rectal enemata, in the treatment of *puerperal eclampsia*.

Spasmodic rigidity of the os uteri is greatly reduced by a medicinal dose of this remedy, and, while its action on the sensory mechanism is feeble, it is nevertheless frequently efficient in modifying the *pains of labor* and in quieting the alarm and allaying the nervous excitement of the mother.

There are certain other pains of moderate intensity, especially those of *neuralgia*, which are temporarily more or less relieved by

chloral. Its anodyne effect, however, is too transient to render chloral very popular as an analgesic.

A combination of morphine and chloral is a very efficient anodyne and hypnotic in sleeplessness due to pain, which is palliated by this combination with less digestive disturbance than if the former drug had been used alone, and less cardiac depression than if the latter had been the sole remedy, the medicines thus aiding each other and serving the twofold purposes of mitigating pain and inducing sleep.

In *sthenic fevers* chloral is an admirable remedy, not only as an antipyretic, but in allaying nervous irritability, restlessness, and excessive cardiac action. It dilates the blood-vessels, causes diaphoresis, and sleep is often of great service.

Contraindications.—Fatty heart; marked respiratory weakness, whether due to acute or chronic diseases of the lungs, atheromatous degeneration of the blood-vessels.

The drug should be administered cautiously, the patient being uninformed as to its nature in certain nervous diseases, lest he acquire the chloral habit.

Administration.—As is recommended in the case of all drugs, only the purest article should be prescribed. Frequently the untoward symptoms of chloral are due more to the impure article than to any idiosyncrasy against it. The recrystallized form alone should be used, the first dose administered not exceeding from 15 to 20 grains (1.0 to 1.2 Gm.), repeated as occasion may demand. Ordinarily a maximum dose should not be given oftener than once in forty-eight hours.

Children bear chloral well, and, as a rule, 1 grain (0.06 Gm.) may be prescribed for each year of the child's age.

Enemas of chloral may be rendered less irritating by mixing the drug with the yolk of an egg and milk. Chloral should always be well diluted when given internally, especially when combined with sodium or potassium bromide. Its disagreeable taste may be partially disguised by mixing the solution with peppermint water and elixir or syrup of orange. It should not be given in strong alcoholic solutions.

Chloralformamidum—Chloralformamidi—Chloralformamide. *U. S. P.*

(CHLORALAMIDE.)

Definition.—A crystalline solid $[\text{CCl}_3(\text{H} \cdot \text{OH})\text{NH}(\text{OH})]$ made by the direct union of formaldehyde and anhydrous chloral.

Description and Properties.—Chloralamide occurs as colorless, shining, odorless crystals, having a faintly bitter taste. It is soluble in 18.7 parts of water and in 1.3 parts of alcohol. Readily soluble in glycerin, ether, acetone, and acetic ether.

Dose. 10 to 30 grains 0.65 to 2.0 Gm.,.

Physiological Action.—Chloral formamide is not so irritating to mucous membranes as chloral. Upon the digestive system it does

not differ essentially from chloral. Its influence upon the circulation is very feeble, producing no perceptible effect upon the pulse in medicinal doses. Its effect upon the cerebral cortex is as pronounced as that of chloral, but in medicinal doses it has no apparent influence upon the spinal cord. Moderate doses seem to stimulate the respiratory mechanism. The temperature is uninfluenced by medicinal doses.

Therapeutics.—It is not employed externally and locally. Its therapeutic uses are similar to those of chloral. As a hypnotic it is said by some observers to be superior when there is cardiac or respiratory weakness. Robinson¹ has not found it free from cardiac depressing qualities. On the other hand, Hagemann and Hüsler recommend it for the relief of cardiac *asthma*. It is much pleasanter to take than chloral. In the *insomnia of neurasthenia* it is especially valuable, and, in conjunction with potassium bromide, is preferable to a like combination with chloral in cases of *seasickness*.

Administration.—It is best given in aromatic elixir or some other dilute alcoholic vehicle. Simple syrup slightly acidulated with hydrochloric acid, beer, and sweet wine are also recommended as pleasant menstrua. When given at night for insomnia the medicine should be taken upon an empty stomach, about one hour before sleeping-time.

Unofficial Chloral Allies.

Croton-chloral (Unofficial).—*Origin*.—Prepared by passing dry chlorine gas into acetic aldehyde, resulting in the formation of butyl-chloral, which is separated by fractional distillation, and water added.

Description and Properties.—Butyl-chloral occurs as a heavy, colorless oil, having an odor resembling that of chloral. The hydrate (croton-chloral hydrate) used in medicine is in the form of white scales, of a silky luster, nauseous taste, and a greenish fruit-like odor. It is freely soluble in alcohol, ether, glycerin, and hot water, but not easily soluble in cold water. Its solutions are unstable, and are decomposed if kept on hand even for a short time.

Dose.—3–20 grains (0.18–1.2 Gm.).

Incompatibles and Synergists are the same as for chloral.

Its *physiological action* and *therapeutics* are quite similar to those of chloral. It was at one time thought that its analgesic properties were more pronounced than chloral and was highly recommended in *faciæ neuralgia*. For the severe cases it is worthless, and for the milder cases other analgesics are far better. It has now little practical use.

Chloral-ammonium.—Obtained by passing a rapid current of dry ammonia through a solution of anhydrous chloral and chloroform as long as it is absorbed. Its chemical name is *trichloromethylammonium chloride*. It occurs as small, white acicular crystals, and is soluble in alcohol and slightly soluble in water, although the aqueous solution is unstable.

Dose.—15–30 grains (1.0–2.0 Gm.).

It has no advantages over chloral.

Chloralose.—Prepared by heating equal quantities of anhydrous chloral and dry glucose, hence the name, *chloralose*.

Description and Properties.—It occurs in the form of fine needles, completely volatilizing without decomposition. It has an acid, nauseous taste, and is soluble in hot water and in alcohol.

Dose.—3–10 grains (0.12–0.6 Gm.).

Chloralose has been found to be more depressing than chloral.

¹ *Drug. med. Week*, 1889, No. 49.

Hypnal.—A compound of chloral and antipyrine, known as *monochlorantipyrine*. A similar preparation containing more chloral is called *di-chloralantipyrine*.

Description and Properties.—It occurs in the form of transparent, rhombic crystals, odorless and tasteless, soluble in from 5 to 6 parts of water.

Dose—5-20 grains (0.35-1.3 Gm.)

The addition of the antipyrine to increase analgesia, while hypothetically good, has not proven of service.

Ural—Chloral-urethane—Uralium.—A compound of urethane and chloral hydrate.

Description and Properties.—A crystalline body, soluble in alcohol and ether, in soluble in cold water, and decomposed by boiling water.

Chloretone—acetone chloroform—is the trade name of an old chemical compound, trichloropseudo butylalcohol.

Description and Properties.—It is a white, crystalline substance, sparingly soluble in cold water, but freely soluble in hot water, ether, alcohol, and chloroform. It has a camphoraceous odor and a not unpleasant taste.

Dose—5 to grains (0.30-0.60 Gm.), or even double this dosage. Best administered in powders or in alcoholic menstruum.

This is undoubtedly a useful hypnotic with an action very similar to that of chloral, but if the recent studies of Impens are to be trusted, it is $2\frac{1}{2}$ times as poisonous as chloral. Chloretone is an excellent antiseptic as well as a hypnotic and has been widely used as a dusting powder for wounds. It has also been employed in the eye and is a marked local anesthetic. Poisonous local effects are reported, however—intense local edema, etc.

Isopral is a closely related compound (trichloriso propyl alcohol).

Hypnone.—As a hypnotic a much weaker substance than chloral, although it has found some advocates as a remedy for the insomnia of alcoholism. Toxic doses paralyze the heart and respiration. It should be given in capsules.

Acetōnum—Acetōni—Acetone. U. S. P.

Definition.—A liquid containing not less than 99 per cent. by weight of absolute acetone (U. S. P.).

Acetone is chemically dimethyl ketone (CH_3COCH_3). It is present to a considerable extent in crude wood alcohol.

Description and Properties.—It is a clear, colorless, mobile, neutral liquid, inflammable, and having an ethereal odor and taste. Specific gravity, 0.790 (25°C .); boiling point, 56.5°C . It is miscible with water and alcohol in all proportions, and is an excellent solvent for fats, resins, rubber, etc. Iodoform is formed when acetone is slightly warmed with an alkali and iodine. Basis of method for determining acetone in diabetic urine. Acetone is used widely in the manufacture of chloroform, iodoform, and sulphone. A number of oleoresins (aspidium, capsicum, ginger, lupulin, and pepper) formerly prepared (U. S. P. 1890) with ether are now prepared with acetone.

Physiological Action.—Acetone resembles ethyl alcohol in its action. It is more potent than ordinary alcohol, as a rule. This may be due to delayed elimination, as is the case in wood-alcohol poisoning, which latter, volume for volume, is less poisonous than ethyl alcohol, but being eliminated more slowly becomes practically more poisonous.

Related Compounds.—When a phenyl radical (C_6H_5) takes the place of one of the methyl groups in acetone, the resulting compounds is phenyl-methyl-ketone ($\text{C}_6\text{H}_5\text{COCH}_3$), also known as acetophenone. This has been used as a hypnotic under the name of *Hypnone*. It is a liquid above 20.5°C . *Malarine* is a condensation product of acetophenone and paraphenetidin. It is usually employed in the form of the citrate.

Salacetolum is a salicylic acid ester of acetol, which is an alcohol

($\text{CH}_3\text{COCH}_2\text{OH}$) derived from acetone; proposed as an antirheumatic.

Aceto-acetic acid, also called diacetic acid ($\text{CH}_3\text{COCH}_2\text{COOH}$), or acetone in which a hydrogen atom has been replaced by (COOH), is found in the urine of many patients suffering from diabetes mellitus. This acetone is thought to be a decomposition product of diacetic acid.

NARCOTICS.

Opium—Opīi—Opium. U. S. P.

Definition.—The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* (L.), and yielding in its normal moist condition not less than 9 per cent. of crystallized morphine when assayed.

The poppy from which opium is derived is indigenous in Western Asia and cultivated in Egypt, Persia, Asia Minor, the elevated plains of India, and in some parts of Europe.

Description and Properties.—Opium appears in irregular or subglobular cakes with the remnants of poppy leaves and the fruit of a species of *Rumex* adhering to their surfaces. Plastic or of a harder consistence, chestnut brown or darker, and somewhat shining internally, showing tears, and fragments of vegetable tissue. It has a sharp, narcotic odor and a peculiar, bitter taste. This description applies to the Smyrna, Levant, Turkey, and Constantinople opium. There are, however, a number of other varieties: viz. 1. Egyptian, flattened, roundish cakes; 2. Persian, black, cylindrical sticks, or small cakes or balls, wrapped in paper; 3. Indian, flat squares covered with mica and wax or an oiled-paper wrapper; 4. Chinese, oblate-spheroidal masses wrapped in white paper; 5. European.

Opium contains about twenty different alkaloids, either in a free state or in combination with some acids. The principal alkaloids, in the order of their medical importance, are morphine, codeine, narcotine, and thebaine; others are narsine, papaverine, cryptopine, pseudomorphine, protopine, hydrocodamine, laudanine, adamine, thesine, meconine, laudanoline, laudopine, oxycodine, and corymorine.

The following constituents of opium are in some respects important: Meconic acid, meconin, meconosin, and morphosin.

In addition to the above, opium contains these substances, making it one of the most complex drugs in materia medica: Mucilage, resin, fats, essential oil, glucose, caustic soda, ammonium, calcium, and magnesium salt, and coloring and coloring matters, besides certain impurities and adulterants, such as stones, fruits, leaves, starch, water, lead, etc.

The total amount of active alkaloids in opium may vary from 5-28 per cent., variations in morphine alone showing from eight to 22 per cent. As opium containing less than 9 per cent. morphine is supposed not to enter the United States, the average of most samples obtained is about 10 per cent., but in the smoking extract lower grades are employed. The Smyrna and Patna varieties, these frequently contain only 2-4 per cent. of morphine.

Dose.— $\frac{1}{4}$ -2 grains (0.015-0.12 Gm.) [$1\frac{1}{2}$ grains (0.1 Gm.), U. S. P.]

The percentage of other alkaloids varies greatly, narcotine which occurs in amounts of from 1-8 per cent. is practically the only other alkaloid of moment.

As to the chemistry of morphine itself, the structural formula is still undecided.

Official Preparations.

Opīi Pulvis—Opīi Pulveris—Powdered Opium.—Dose, $\frac{1}{4}$ -2 grains (0.015-0.12 Gm.) [1 grain=0.05 Gm.), U. S. P.]

Powdered opium should yield not less than 12 nor more than 12.5 per cent. of crystallized morphine.

Acetum Opii (10 per cent.)—**Aceti Opii**—Vinegar of Opium.—*Dose*, 3-15 minims (0.18-1.0 Cc.).

Extractum Opii (20 per cent. of morphine)—**Extracti Opii**—Extract of Opium.—*Dose*, $\frac{1}{8}$ -1 grain (0.01-0.06 Gm.).

Emplastrum Opii (6 per cent. of extract of opium)—**Emplastrum** (acc.) **Opii**—Opium Plaster.—For external use.

Formula. Extract of opium, 60; Burgundy pitch, 180; lead plaster, 780; water, 80.

Opium Deodoratum (12 to 12.5 per cent. of morphine)—**Opi Deodorati**—Deodorized Opium (DRENARCOTIZED OPIUM)—*Dose*, $\frac{1}{4}$ -2 grains (0.015-0.12 Gm.).

Opium Granulatum (12 to 12.5 per cent. of crystallized morphine)—*Dose*, 1 grain (0.05 Gm.), U. S. P. Now used for making tr. opi instead of using the op. pulv.

Pilule Opii (1 grain, or 0.065 Gm., in each pill)—**Pilulas** (acc.) **Opi**—Pills of Opium.—*Dose*, 1 or 2 pills.

Pulvis Ipecacuanhæ et Opii—**Pulvis Ipecacuanhæ et Opi**—Powder of Ipecac and Opium (DOVER'S POWDER)—*Dose*, 5 to 10 grains (0.3-0.6 Gm.).

Formula: 1 grain (0.06 Gm.) opium, 1 grain (0.06 Gm.) ipecac, 8 grains (0.5 Gm.) sugar of milk, in every 10 grains (0.6 Gm.).

Tinctura Opii (10 per cent.)—**Tinctura Opii**—Tincture of Opium (LAUDANUM)—*Dose*, 5-15 minims (0.3-1.0 Cc.).

13 minims (0.78 Cc.) represent about 1 grain (0.06 Gm.) of opium.

Tinctura Opii Camphorata—**Tinctura Opii Camphorata**—Camphorated Tincture of Opium (PARRESCOT)—*Dose*, $\frac{1}{2}$ -1 fluidrachm (2.0-15.0 Cc.).

Formula: Sweetened gum, 4; benzoic acid, 4; camphor, 4; oil of anise, 4; glycerin, 40; diluted alcohol, to 1000. Prepared by maceration and percolation. 4 fluidrachms (15.0 Cc.) represent about 1 grain (0.06 Gm.) of opium.

Tinctura Opii Deodorati (10 per cent.)—**Tinctura Opii Deodorati**—Tincture of Deodorized Opium—*Dose*, 5-15 minims (0.3-1.0 Cc.).

Tinctura Ipecacuanhæ et Opi—**Tinctura Ipecacuanhæ et Opi**—Tincture of Ipecac and Opium (TINCTURE OF DOVER'S POWDER)—*Dose*, 5-15 minims (0.3-1.0 Cc.).

10 minims (0.6 Cc.) contain 1 grain (0.06 Gm.) each of opium and ipecac.

Trochisci Glycyrrhiæ et Opii—**Trochiscos** (acc.) **Glycyrrhiæ et Opi**—Troches of Liquorice and Opium.—*Dose*, 1 to 3 troches.

Each troche contains about $\frac{1}{4}$ grain (0.005 Gm.) of opium.

Vinum Opii (10 per cent.)—**Vini Opii**—Wine of Opium.—*Dose*, 5-15 minims (0.3-1.0 Cc.).

The description and properties of the official alkaloids of opium and their salts are as follows:

Morphina—**Morphina**—Morphine.—Colorless or white, shining, prismatic crystals, or fine needles, or a crystalline powder, odorless, having a bitter taste, permanent in the air. Soluble in 3330 parts of water, in 168 parts of alcohol, in 1040 parts of water at 80° C., and in 36 parts of boiling alcohol. It melts at 254° C. *Dose*, $\frac{1}{2}$ - $\frac{1}{4}$ grain (0.008-0.015 Gm.), [$\frac{1}{3}$ grain (0.1 Gm.), U. S. P.]

Morphina Acetas—**Morphina Acetatis**—Morphine Acetate.—A white or faintly yellowish-white, crystalline or amorphous powder, having a faint, acetic odor and a bitter taste. Soluble in 25 parts of water and in 21.6 parts of alcohol. On protracted exposure to the air the salt gradually loses some acetic acid, becoming less soluble. It should be kept in dark amber-colored, well stoppered bottles. *Dose*, $\frac{1}{4}$ - $\frac{1}{2}$ grain (0.008-0.015 Gm.).

Morphina Hydrochloridum—**Morphina Hydrochloridi**—Morphine Hydrochlorate.—White, feathery needles, of a silky luster, or minute, colorless, cubical crystals, odorless, having a bitter taste, permanent in the air. Soluble in 17.2 parts of water and in 42 parts of alcohol at 25° C. *Dose*, $\frac{1}{2}$ - $\frac{1}{4}$ grain (0.008-0.015 Gm.).

Morphina Sulphas—**Morphina Sulphatis**—Morphine Sulphate.—White, feathery, acicular crystals, of a silky luster or in cubical masses, odorless, of a bitter taste, permanent in air. Soluble in 15.3 parts of water and in 465 parts of alcohol at 25° C. *Dose*, $\frac{1}{4}$ - $\frac{1}{2}$ grain (0.008-0.015 Gm.).

Codeina—**Codeina**—Codeine.—White or nearly translucent, orthorhombic prisms, or octahedral crystals, or a crystalline powder, odorless, having a faintly bitter

taste, and slightly efflorescent in warm air. Soluble in 88 parts of water and in 1.6 parts of alcohol at 25° C. *Dose*, $\frac{1}{4}$ -2 grains (0.03-0.12 Gm.).

Codeinæ Phosphas—Codeinæ Phosphatis—Codeine Phosphate.—Fine white crystals. Bitter taste. Soluble in 2.25 parts of water and 1.261 parts of alcohol at 25° C. *Dose*, $\frac{1}{4}$ grain (0.03 Gm.), U. S. P.

Codeinæ Sulphas—Codeinæ Sulphatis—Codeine Sulphate.—Long glistening white crystals, efflorescing in the air. Soluble in 30 parts of water and 6.25 parts of alcohol at 25° C. *Dose*, $\frac{1}{4}$ grain (0.03 Gm.), U. S. P.

Pulvis Morphine Compositus—Pulveris Morphine Compositi—Compound Powder of Morphine (TULLY'S POWDER). *Dose*, 5-15 grains (0.3-1.0 Gm.).

Formula: Morphine Sulphate, 1.5; Camphor, 32; Glycyrrhiza, 33; Precipitated Calcium Carbonate, 33; Alcohol, q. s. to 100.

Antagonists and Incompatibles of Opium and its Alkaloids.

—The physiological antagonists are atropine, strychnine, coffee or caffeine. Quinine antagonizes some of the cerebral effects of the drug, while tartrate of antimony and potassa (tartar emetic) and digitalis oppose its action on the intracranial circulation. The incompatibles are alkalis, tannic acid and infusions containing it, and salts of lead, iron, copper, mercury, and zinc.

The following are incompatible with morphine and its salts: iodine and iodides, bromine and bromides, Fowler's solution, and sodium borate.

Synorgists.—The hypnotic action of opium is aided by the hypnotics; its anodyne influence is enhanced by belladonna and cocaine, and its sudoriferous effects by ipecacuanha.

The physiological action of opium differs in some respects from that of morphine or codeine, and will therefore be described first.

Externally and Locally.—Applied to the unbroken skin, opium possesses feeble analgesic properties, and from mucous membranes or raw surfaces it is readily absorbed, producing slight anodyne effects.

Internally.—Digestive System.—Its prominent action is upon the secretions—checking that from the salivary glands, causing great dryness of the mouth and consequent thirst—largely diminishing those from the stomach, and reducing the bile and pancreatic juice secreted. In fact, every secretion of the body is lessened except the perspiration, the cause being the depressing influence of the drug upon the secretory centers in the medulla. It may be added that the peristaltic movements of the digestive apparatus are reduced, which, together with diminished secretions, impair digestion and produce constipation.

The sensation of hunger is invariably diminished under its administration.

The action upon the intestines, however, varies with the dose administered, moderate or full medicinal doses checking peristalsis and promoting constipation. On the other hand, very large or very small doses increase peristalsis, the former augmenting this effect, and producing violent movement of the bowels through the drug's paralyzing action on the splanchnic inhibitory fibers of the intes-

tine, so that inhibition is removed and peristalsis reinforced. Very small doses act as purgatives when by some reflex disturbance, such as a tender ovary, the peristalsis is inhibited. It is not yet certain whether this action is largely due to local causes, as morphine is excreted into the intestines, or is of central origin. Minute quantities, by partially benumbing the inhibitory nerves or diverting the stimulus from them to the stimulating fibers, relieve constipation. This action is rendered serviceable in the similar constipation accompanying lead poisoning, the metal constipating the patient not only by its astringent action, but also by the tetanic spasm of the intestines caused by the irritating action of the lead upon the mucous membrane. The feces are held by spasmodic intestinal contraction, relief of which by a small dose of opium, sufficient to induce peristalsis, will be followed by evacuation.

Circulatory System.—Small doses accelerate the pulse, rendering it fuller and firmer, and dilate the arterioles, though increasing arterial tension. The chief activity of opium is on the central nervous system. Large doses, while primarily quickening, soon retard the heart's action, rendering the pulse slow. This influence is occasioned by stimulation of both ends of the vagus. Should the dose be lethal, the pulse may become rapid and weak from over-stimulation, and consequent exhaustion of the vasomotor center and pneumogastric nerves. As asphyxia deepens, the heart grows weaker, but usually continues beating after respiratory failure.

Nervous System.—One of the early symptoms of taking opium is a condition of well-being—a euphoria. In it the patient is in a state of dreamy consciousness, the skin is warm and pleasant, and all outside worries, cares, pains, or distresses are cut off from the attention. This is narrowed to the patient's own feeling of happiness. Preceding the full development of the euphoria there is little doubt that a certain amount of primary stimulation takes place. This may be due to the increased blood-supply, frequently manifesting itself in the skin by itching, or it may result from primary irritation, although experiments on lower animals have induced many observers to question the occurrence of any primary stimulation. In the habitué there is no doubt of the stimulation of the initial stages, but in this class an entirely different series of physiological and psychological activities is at work. In the stage of euphoria a certain heightening of the imagination occurs, particularly in certain types of mental organization. This readily becomes incoordinated, however, and very frequently highly exaggerated, leading to the characteristic fantasies colloquially termed "pipe dreams." Sleep follows or intermits in this stage. In the light grades of sleep, the patient may be easily aroused, and, as a rule, when the outside irritant is sufficiently acute to enter into the field of attention, the sleeper is suddenly and usually thoroughly aroused. He often awakens with a sudden start—is keenly alive to the surroundings, and if unnecessary to bestir himself, sinks back into slumber. Very often the sleep is a fitful, restless sleep, with semi-waking

periods and short naps seeming to extend over very great periods of time. In the more profound sleep, awakening is difficult and the patient, after being aroused, sinks back into a profound coma.

On awakening, nausea and vomiting are usual, often a severe and miserable headache, which persists a part of the following day.

Opium is one of the most powerful analgesics known. Pain is relieved, probably through the depressing influence of the drug on the perceptive centers in the brain, although it is possible that the entire sensory apparatus, the peripheral ends of the sensory nerves, the conducting path in the spinal cord, and the receiving cerebral center are more or less influenced by the drug.

The action of opium on the spinal cord is complex, since it contains a number of alkaloids which resemble strychnine as well as morphine, whose action is almost entirely cerebral. In the lower animals and in children there is increased reflex excitability from the action of codeine, narcotine, and thebaine, the last resembling strychnine very closely in its action on the reflex motor mechanism of the cord.

Respiration.—The action of opium on the medullary centers is very pronounced, particularly upon the respiratory center.

In very small doses opium slightly stimulates respiration; in full or large doses it is a strong respiratory depressant, its action being upon the center in the medulla. Death is usually caused by paralysis of respiration, the respirations sinking to 6-8 or even less to the minute, and becoming shallower and shallower. In the late stages of poisoning Cheynes-Stokes respiration usually develops.

Absorption and Elimination.—Opium is rapidly absorbed, and is eliminated chiefly by the gastro-intestinal mucous membrane and very little by the kidneys.

Moderate quantities of the drug are oxidized in the body, though when large doses are administered opium may be found unchanged in the urine. It is also excreted in the bile, in the milk, and to some extent in the sweat, which is largely increased by opium, particularly when the drug is combined with ipecacuanha, as in Dover's powder. The sweat is the only secretion augmented by opium, although the manner in which sudoriparous glands are stimulated is not positively known—whether centrally or peripherally.

All other secretions are diminished by opium.

The reabsorption of opium may be prevented by frequently washing out the stomach and intestines, from which viscera the drug is mainly eliminated.

Metabolism.—The action of opium on metabolism is very marked. It locks it up. Lactic acid occurs in the blood from defective oxidization. It diminishes internal cell-oxidization; by limiting muscular activity it lessens the muscle metabolism; and by diminishing the excursions of the respiratory muscles, limits respiratory oxidation and CO_2 formation. Patients may be kept alive a long period of time under the administration of opium, and it plays a very important rôle in the feeding habits of the Orientals.

Temperature is at first raised, but later lowered when free diaphoresis and muscular quiescence are established.

Eye.—The pupils are minutely contracted by large doses, the *modus operandi* not being fully understood, though probably the action is due to stimulation of the oculomotor center. The pupil usually dilates just before death.

Untoward Action.—Headache, disturbances of hearing, muscular tremor or temporary paralysis, itching of the skin with or without eruption. In case the latter symptom appears, it is commonly in the form of a small red spot resembling roseola. An erythematous inflammation may affect the mucous membrane of the mouth and throat.

Morphine has produced paresthesia of the sense of taste, as well as spasm of accommodation of the eye and edema of the eyelids. Many other untoward manifestations occur, even under minute doses, in persons having an idiosyncrasy against the drug.

Tolerance.—It is a notable fact that the body may become readily accustomed to morphine, and that a distinct tolerance becomes established. Chronic morphine-takers may use enormous quantities, some as high as 100 grains of morphine a day. Whether there is formed in the body an immune substance, thus permitting of such large dosage is not yet established. The researches on dogs by Faust and others would seem to show the possibility of an antitoxic substance being formed, but the question is still open for further investigation. Faust's work also showed that the power of the body to oxidize morphine increases.

Poisoning.—Small medicinal doses of opium, as is known, tend to produce moderate excitement, a pleasing sense of freedom from care, and in sleep, tranquil, even happy, dreams. Far otherwise it is with *toxic doses*. Under their influence the entire physiological conditions of the system are perverted. Here the drug exerts its baneful effects, and the mind rapidly succumbs to a power over which it has no control. The period of excitement is fleeting, the predominating desire of the patient being to *sleep*, and from the dull, lethargic stupor which supervenes he is roused only by vigorous and unremitting treatment. Giddiness portends this mental and physical state. The pulse, though still full, diminishes in frequency; the breathing becomes heavy and labored, and finally stertorous; the heart is now apparently seized with an indefinable oppression, and the pupils are visibly contracted; the skin is moist and warm, and the face suffused or at length of a marked cyanotic hue, cutaneous eruptions being not uncommon. Should relief be not forthcoming, the pulse continues to sink; the drowsiness and subsequent lethargy are followed by a state of true coma; the muscular system is wholly relaxed; the reflexes are obliterated, and death ensues from respiratory failure, the asphyxia being closely accompanied by cessation of the heart's action. The toxic dose ranges from 2 to 10 grs.

In the *treatment of acute opium-poisoning* at least three objects are of paramount necessity: to eliminate the poison, maintain respiration,

and prevent failure of circulation. The first of these may be attained by emptying the stomach and evacuating the bowels. Active stimulants and irritating emetics are of great service, the latter being assisted by frequent and copious draughts of warm water in the intervals of vomiting, and the doses being large in order to make an impression upon the insensibility of the stomach. Chemical antagonists, such as tannic acid, permanganate of potassium, should be tried. Physiological antagonists, as caffeine, in hot strong coffee or tea (with tannin), and atropine, are the most efficient. Too much atropine should not be administered. Hot saline infusions are occasionally very helpful in diluting the poison in the blood. Counterirritants, flagellation, shouting in the ear, may rouse the patient from his lethargy. Artificial respiration by Sylvester's method, or by a pump is imperative in the very toxic cases. Awakening the patient is very helpful in aiding respiration.

Chronic opium-poisoning, resulting from the habitual use of opium, its most active constituent morphine, or its salts, is undoubtedly one of the most pernicious habits to which the human body can be subjected, its mental, moral, and physical phenomena being among the saddest and most terrible known to therapeutics.

The conditions inducing the opium habit are frequently caused, or are largely influenced, by the therapeutic employment of the drug—as was the case with De Quincey, whose graphic analysis of the Pleasures and Pains of opium, if possibly to be taken *cum grano salis*, is at once the most powerful and the most eloquent ever written. The patient who has once experienced the anodyne influence of the drug—as captivating to his senses as though it were a draught of the fabled Lethe—readily yields to it upon the slightest occasion, as, for instance, to alleviate trivial indispositions for which, in ordinary circumstances, he would ridicule the idea of medical treatment. With repeated indulgence—often promoted by a casuistic reasoning of which by degrees the subject is scarcely conscious, or by persistent and intentional deception—comes the craving which knows no restraint, and which can be quieted only by complete mental and physical regeneration or the merciful release of death.

The symptomatology observed in the chronic habitués varies considerably. Many people take opium or morphine for many years without showing many evil effects. Beyond a marked grade of peculiar anemia, often skilfully hidden by women, and certain eccentricities of behavior, even the trained observer may not be able to detect even the confirmed habitué, especially when such is found under good hygienic and social conditions. These high-grade habitués often live a sweet-do-nothing existence, their habit constituting one of the family skeletons.

In the more abject phases severe anemia, with marked pallor, extreme emaciation, and greatly depreciated physical, mental, and ethical powers are characteristic.

During the life history of practically every habitué attempts are made to overcome the habit. The discontinuance of the drug in-

variably brings on a series of abstinence or withdrawal symptoms characterized mainly by stages of vasomotor paresis. Thus, diarrhea with marked painful peristalsis, running from the nose and eyes, intense neuralgic pains, and a most distressing restlessness are very constant. If the patient can fight it out for thirty-six to seventy-two hours these symptoms abate, and there is hope for a cure, temporary at least.

In the treatment of this condition much can be accomplished from the purely personal side. Treatment is usually best carried out in a trustworthy sanitarium, where a reliable trained nurse should be in constant attendance. This surveillance should be continued long after the drug has been discontinued and the cessation of active treatment. A morphine habitue is by no means cured when the drug is discontinued. The general outline will consist of substituted sensations, substituted ideas, and general tonic and supportive treatment. To accomplish the former purpose, after almost complete withdrawal of the drug has been brought about, codeine, heroin, diionin, hyoscine may be used to create a sense of euphoria, which differs in some respects from the old euphoria of the drug. One of the best hypnotics is a combination of sulphonal with a vegetable neurotic like conium or hyoscyamus. The bromide salts in large doses may be employed. The morphine user is always a victim of toxemia from arrested functions of the kidneys, liver, and adrenals, and intestinal antiseptics, laxatives, and cathartics are a necessary part of the treatment. Hydrotherapy properly employed is invaluable. Static electricity or electric baths are of great value in some cases, but not in all. The immediate surroundings of the patient should be made as pleasing as possible. Food and medicine should be given in the most agreeable forms consistent with usefulness, and the same kind of attention paid to every method of treatment employed.

Suggestion is a potent factor in the treatment of morphinism, and the physician should employ it constantly and encourage his patient in every possible way. After the withdrawal of the morphine, the treatment should combine nerve and mental rest, tonics, diversion, and, by all means, elimination, suggestion, encouragement, and close surveillance for some months. An excellent tonic and supportive drug during the withdrawal of morphine is strychnine nitrate in small doses frequently repeated (gr. $\frac{1}{100}$), so as to secure a cumulative effect.

The treatment of so dire a malady—for such the chronic use of opium must be regarded—demands the utmost forethought, patience, and tact. The method of sudden, absolute withdrawal of the drug is admitted by the wisest observers to be fraught with danger commensurate with that of the indulgence to be overcome. Collapse, delirium, and other serious results have attended so drastic a measure, the general opinion obtaining to-day being that a gradually reduced dose of the drug is the safest and most rational mode of procedure. The conditions are extremely difficult to combat suc-

cessfully, repeated hypodermic injections being eradicated from the system far less readily than opium from the stomach. The moral nature of the patient, too, has become so perverted that little or no reliance can be reposed in his veracity, the physician being thrown upon his unaided resources, supplemented by the untiring vigilance and fidelity of the attendant.

The gravity of the situation should from the first be fully realized, since it is too often simply a case of life or death, the patient being not infrequently seized with the desire of self-destruction in the extremity of mental anguish occasioned by the ordeal imposed by unwonted abstinence. Could he be put upon his honor, and that honor be steadfast, his co-operation would be invaluable. But this assistance is seldom at command, the patient's loyalty of purpose and unswerving resolution, as professed, being wholly subservient to a volition long since weakened, if not annihilated, by pitiful sophistries and moral degradation. Nevertheless, the case must be approached from the sympathetic side, and every means of inspiring confidence employed, remembering that a human will, as well as body, is under treatment, and that mental sanity, as well as physiological health, is to be restored.

While a successful outcome is not always to be expected, much can be accomplished by persistent effort in these cases. They are not hopeless by any means.

Therapeutics.—In a general way the medical uses of opium are—1, to relieve pain; 2, to produce sleep; 3, to lessen reflex irritation; 4, to diminish secretion; 5, to support the system; 6, to act as a sudorific.

Opium is the most important and useful drug known to medicine, as well as the most remarkable in its multifarious applications. It would, therefore, be idle—indeed, well-nigh impossible—to enumerate all the maladies and abnormal conditions for which this invaluable remedy has been employed. It perhaps best represents the typical symptom medicine, being used almost invariably for the relief of one or more symptoms of disease, rather than for its specific or direct curative action upon the disease itself. Unless some special contraindication exists, it may be employed when any of the above medical uses are desired.

Externally and Locally.—It is used to relieve pain, either in the form of an ointment, a liniment, or a suppository, the most popular form, perhaps, being the lead-and-opium lotion.

Internally.—**Pain.**—Either OPIUM or MORPHINE may be used for the relief of pain, regardless of the seat or cause. Pain of moderate intensity may often be allayed by other analgesics, such as antipyrine, acetanilid, etc.; but when it is severe or excruciating, it is useless to experiment with other drugs when so potent an agent of relief as opium is obtainable. As a general principle, it should be borne in mind that opium should, if possible, be avoided in all pains of an essentially chronic nature, if the habit is not to be acquired. One is justified, however, in the employment of opium

or morphine indefinitely for the relief of pain or insomnia in incurable cases.

Sleep.—It is not recommended for ordinary use to produce sleep, because of its seductive, insidious action, and the danger of creating in the patient a tendency toward the opium habit. When, however, sleeplessness is occasioned by pain, and in the *insomnia of delirium tremens* or *acute delirium*, opium or some one of its preparations is often an indispensable remedy.

Spasm.—Spasmodic conditions of involuntary muscles, as in cases of *asthma*, the convulsions of *tetanus*, *uremia*, *hydrophobia*, frequently call for a drug as powerful as opium.

When given in proper doses in peritonitis, opium reduces peristalsis and removes the pain, promoting the patient's comfort and supporting his vital powers. It diverts the blood from the congested peritoneum by dilating the cutaneous blood-vessels. Furthermore, it possesses the peculiar property of causing the irritation in the inflamed area to contract reflexly the local blood-vessels, thus diminishing the blood-supply to the diseased part.

It is manifestly of little service beyond its pain-relieving effects in the peritonitides of septic appendicitis or of other acute bacterial peritonitides. If its use tends to mask the symptom of pain in appendicitis, thus rendering diagnosis more difficult, it is to be avoided.

Secretion.—In *dysentery*, *cholera morbus*, and *cholera*, it has been used with excellent results, having also been employed in many cases of excessive secretion in other portions of the body.

Opium is frequently given in *bronchitis* with profuse secretion and irritable cough, in which condition it acts favorably through depression of the reflexes and power to allay irritation and check secretion. In these cases, however, small doses only should be administered, and the condition of the patient carefully watched, especially that of the aged, lest the respiratory apparatus be so depressed that expulsion of the accumulated viscid mucus be impossible and danger of death from suffocation ensue.

Metabolism.—As a supporter of the system when the vital forces are weakened by acute or chronic disease or injury there are few drugs as efficacious as opium. It calms and strengthens the debilitated heart, and secures the patient refreshing sleep, soothing and invigorating his system by means of the much-needed rest. If pain be persistent, wearing seriously upon the sufferer's vitality, opium by its anodyne influence enables him to recuperate during the interval of relief.

In *shock* from severe injury, opium, by benumbing sensation and depressing the reflex mechanism, lessens the danger of cardiac and respiratory failure.

In *pleurisy* it is the most efficient remedy, relieving congestion as in peritonitis, besides reducing the respirations, and consequently the friction of the inflamed pleural surfaces, as well as allaying the pain accompanying each respiration.

DOVER'S POWDER is a common and valuable agent in *acute coryza*, it also being one of the most efficient diaphoretics.

OPIMUM is considered the most efficacious remedy in *puerperal septicæmia*. It has also been advocated for *hemorrhage*, both active and passive, its greatest utility being manifested in the latter condition. It is particularly valuable in the hemoptysis of phthisis, and useful in hemorrhage in typhoid.

Although frequently used in *continued fevers* of various kinds, it is indicated, as a rule, only during their course—or, rather, after the fever is well established or during its decline—to mitigate its violence or conserve the strength and relieve the nervous manifestations foreboding exhaustion. Clinical experience has demonstrated its inutility, ordinarily, at the onset or climax of such fevers. Even in *exanthematous fevers* opium has proved valuable when the eruption is delayed. The presence of narcotine is said to be of assistance in the treatment of malaria.

As already intimated, the space allotted to this drug will scarcely permit an enumeration of the many disorders for which this remedy has been successfully administered. The independent and thoughtful physician, knowing the chief indications for its use, will find no difficulty in employing opium alike to the relief of the patient and his own satisfaction.

Contraindications.—If avoidable, opium should not be given to children under five years of age. Should the necessity of administration under that age be deemed advisable in the judgment of the physician, it should be remembered that the drug acts with greatly disproportionate power upon the nervous systems of the young. 1 minim (0.06 Gm.) of tincture of opium having caused the death of a child one day old, and a few drops of camphorated tincture of opium having proved fatal to an infant of nine months. The death of a nursing babe is even recorded; the mother having taken a medicinal dose of laudanum.

Opium is contraindicated in excessive bronchial secretion of the aged, during the second stage of pneumonia, in cerebral congestion, and in alcoholism.

Administration.—As has been stated under *Poisoning*, there are many circumstances which modify the action of opium, the young and the old requiring smaller doses and great care in administration. For children the best preparation is paregoric. Females, moreover, need smaller doses than males, since they are more readily affected by the drug and more subject to untoward manifestations, such as nausea, headache, etc.

Caution should be exercised in administering opium to those who have an idiosyncrasy against it. On the other hand, persons addicted to the opium habit require enormous doses to make a medicinal impression.

Agonizing pain seems to antagonize the drug, so that in *peritonitis* or during the passage of *biliary* or *renal calculi*, in *severe neuralgia*, *tic douloureux*, etc., opium is well borne, doses which

under other conditions might produce dangerous symptoms having little effect save to deaden the pain, frequently not even inducing sleep.

In other cases, such as *nephritis*, very small doses may be followed by serious and alarming consequences, continued administration resulting in an accumulation of the drug in the system, owing to defective elimination. Should prolonged administration be desirable, it is necessary to increase the dose gradually in order to produce the requisite effect, because of the growing tolerance to the drug.

Certain preparations are preferable in given conditions. Thus, if it be necessary to produce diaphoresis, Dover's powder or some other combination with ipecac is advisable. When relief of pain, unless it be intense, is desired, small doses of morphine or tincture of opium will usually be sufficient, full doses being required to produce sleep.

The deodorized tincture of opium causes less disagreeable symptoms than the plain preparation, which contains narcotine. Potassium bromide is said to prevent untoward after-effects.

When opium is demanded for its astringent action, it should be given in small or stimulant doses or combined with chalk or with some of the astringents. The camphorated tincture, owing to the camphor it contains, is probably the most astringent liquid preparation of opium, and is therefore preferable in cases of diarrhoea, as it is the favorable form as an adjunct to cough-mixtures.

When the prolonged sedative and astringent effect of opium is desired, as in *intestinal hemorrhage*, *diarrhoea*, *nausea*, and certain *diseases of the stomach*, an old, dry opium pill or pill of opium and lead is better than any liquid preparation of morphine, owing to its tardy solution.

In *diseases of the rectum* requiring opium a suppository containing the extracts of opium and belladonna is perhaps the best combination to use.

Ovarian and *pelvic pain* more readily succumbs to the anodyne action of codeine than distress in other parts of the body.

When opium is used as a soporific, it is best to combine it with chloral, a small dose only of each being necessary. These unite in their action upon the brain, depressing the heart less than if chloral alone had been given, and are attended by less serious after-effects than had morphine been the sole agent employed.

Opium prolongs the narcotic effect of chloroform, and in certain operations it is good practice to administer a dose of the drug, following it soon with a few inhalations of the anesthetic.

The hypodermic injection of morphine is usually preferable to the internal administration of opium in cases of severe pain, since a smaller dose is required and a much more rapid effect produced, with less danger of affecting the appetite and bowels.

The many circumstances influencing the action of the drug appear to confirm the statement that "there is no dose of opium."

its conduct being wholly dependent upon the age, sex, idiosyncrasies, and condition of the patient. The amounts given under the different preparations are such as experience has shown to be safe ordinarily as the initial ones for adults, succeeding doses being adjusted according to the indications of the individual case.

CONTRASTS OF OPIUM AND ITS ALKALOIDS.

It has been pointed out that opium is a very variable body. Its chief action is dependent on morphine, which is found, as a rule, in the largest amounts. Occasionally the morphine strength is low, and thebaine or narcotine percentage high. In this event the tetanizing activities of these alkaloids becomes prominent. The alkaloids in opium seem to show a regular series of gradations in activity from morphine, through papaverine, codeine, and narcotine, to thebaine; in the former of which the cerebral activities are more manifest, while for narcotine and thebaine there is greater action on the spinal reflexes. Narcotine approaches strychnine in this respect.

Morphine is naturally much more certain in its action than opium. Papaverine is intermediate between morphine and codeine, but is a weak alkaloid. Opium possesses greater diaphoretic properties than morphine. Morphine produces more irritability of the bladder and occasions much greater itching of the skin than opium.

Codeine represents a middle activity. It is less depressing to the cerebral functions, and much less poisonous to the medulla; in children its stimulating action on the spinal cord may be manifest. It is much weaker than morphine, and rarely causes the unpleasant after-effects of this alkaloid. Codeine has a more selective action than morphine upon the nerves of the abdominal viscera; is less constipating than morphine or opium, and has comparatively little effect in medicinal doses upon the respiration.

The remaining alkaloids are present in very small quantities and are therapeutically negligible. Narceine was at one time considered highly poisonous, but later research has failed to confirm Claude Bernard's early dicta.

Allied Morphine Compounds.

Heroin—Diacetyl Morphine—This is an acetic ester of morphine. It is a white crystalline powder, of faintly bitter taste but practically insoluble in water, but rendered soluble with dilute acids. It is useful as a substitute for morphine as an anti-spasmodic in cough, and is particularly valuable in respiratory difficulties. It is less of a cerebral depressant. Its use can bring about a habit. *Dose*, $\frac{1}{10}$ grain 0.005-0.1 Gm.

Dionine—Monacetyl Morphine Hydrochloride.—This is much similar to the preceding, a single acetyl ester entering into the combination. It has much the same properties, but is deemed more poisonous. Severe poisoning has resulted. *Dose*, not less than $\frac{1}{10}$ grain 0.012 Gm.

Peronine.—This is an analogous compound—the benzyl ester of morphine. It is rarely employed as a remedy. *Dose*, up to 1 grain (0.06 Gm.).

Hūmulus—Hūmuli—Hops. U. S. P.

Definition.—The carefully dried strobiles of *Humulus Lupulus* L., bearing their natural glandular trichomes.

Description and Properties.—Ovate, about 3 Cm. long, consisting of a thin, hairy, undulating axis and numerous obliquely ovate, membranaceous scales, the upper portion of which is reticulately veined and the lower parallel-veined, glandular, surrounding a subglobular akene; color of the scales greenish, free from reddish or brownish spots, odor aromatic, and taste bitter, aromatic, and slightly astringent. The active and important constituent is—

Lupulinum—Lupulini—Lupulin. U. S. P.

Definition.—The glandular trichomes separated from the fruit of *Humulus Lupulus* L.

Description and Properties.—Bright, brownish-yellow, becoming yellowish-brown, resinous, consisting of minute glands which under the microscope are seen to be subglobular, or, rather, hood-shaped, and reticulate—aromatic and bitter.

Dose of Lupulin.—5-30 grains (0.3-2.0 Gm.).

Official Preparations of Lupulin.

Fluidextractum Lupulini—Fluidextracti Lupulini.—Fluidextract of Lupulin.—*Dose*, 5-30 minims (0.12-2.0 Cc.).

Oleoresina Lupulini—Oleoresinæ Lupulini—Oleoresin of Lupulin.—*Dose*, 1-5 grains (0.06-0.3 Gm.).

Physiological Action.—*Internally.*—**Digestive System.**—The action of hops is similar to that of vegetable bitters, augmenting the secretions from the salivary and gastric glands, thereby promoting appetite and digestion.

Circulatory System.—The heart's action is slightly increased, the remedy also raising arterial tension and exciting the cutaneous circulation. Lupulin is a mild somnifacient and diuretic. As a general pain-relieving agent it is to be classed with the milder anodynes. In the colics of children it is of great service. In *neurasthenia* and *hysteria* it has a calmative influence, lessening the irritability and often promoting sleep.

The combined tinctures of lupulin and capsicum serve as excellent substitutes for alcoholic stimulants during the treatment of *alcoholism*, as well as being useful remedies in mild attacks of *delirium tremens*.

Administration.—Lupulin and oleoresin of lupulin are best given in pills and capsules respectively. The tincture and fluid-extract should be administered in syrup. Aromatic spirits of ammonia forms a good vehicle when it must be given in liquid form.

Lactucārium—Lactucārii—Lactucarium. U. S. P.

Definition.—The concrete milk-juice of *Lactuca virrosa* L., a biennial rank-smelling herb growing in Europe.

Description and Properties.—It occurs in sections of plano-convex, circular cakes, or in irregular, angular pieces, externally grayish-brown or dull reddish-brown, internally whitish or yellowish, of a waxy luster, heavy narcotic odor, and somewhat bitter taste. It contains lactucin, lactucopictin, lactucic acid, lactucerin, and wax.

Dose.—5-60 grains (0.3-4.0 Gm.).

Official Preparations.

Tinctura Lactucarii—**Tinctura Lactucaria**—**Tincture of Lactucarium.**—*Dose*, $\frac{1}{2}$ –2 fluidrachms (1.0–8.0 Cc.).

Syrupus Lactucarii—**Syrupus Lactucari**—**Syrup of Lactucarium.**—*Dose*, 1–4 fluidrachms (4.0–15.0 Cc.).

Physiological Action and Therapeutics.—It has been thought that lettuce contains a body somewhat resembling hyoscyamine. If this is so the reputed soporific effects are explainable. Its action is in no wise like opium. It is extremely slightly soporific and also diuretic, which properties, especially in the syrup form, render it of some value in cases of *irritating cough*, as well as in *sleeplessness and nervousness of children*.

Cannabis Indica—Cannabis Indicae—Indian Cannabis. U. S. P.

(INDIAN HEMP)

Definition.—The dried flowering tops of the pistillate plant of *Cannabis sativa* L., grown in the East Indies and gathered while the fruits are as yet undeveloped and carrying the whole of their natural resin.

Description and Properties.—The article of commerce consists of bundles of a few flowers, the branches and bracts, and nearly ripe fruit, the whole more or less agglutinated by a resinous exudation. Of a brownish-green color, peculiar narcotic odor, and slightly acid taste. The exact composition of cannabis is not known. It is an extremely variable drug, and plants in different countries display great diversity in amount of active constituents. It is thought that only the tropical varieties are effective.

The active constituents are not yet definitely isolated. They exist in a mixture of resins and volatile oils, termed for convenience only *Cannabinol*; but no one body that may be said to possess the pharmacological characters of the crude drug has yet been positively determined as to its chemical structure.

The crude drug is commonly called in India "gunjah," "Bhang," "widdi," or "hashish," the term usually employed from whose toxic effects, frequently inciting to murder, is said to be derived our word "assassin" is another form of cannabis appearing as the Arabian confection prepared by mixing aromatics with fruits and dried leaves.

Dose.—2–5 grains (0.12–0.3 Gm.).

Official Preparations.

Extractum Cannabis Indicae—**Extracti Cannabis Indicae**—**Extract of Indian Cannabis.**—*Dose*, $\frac{1}{2}$ –1 grain (0.015–0.06 Gm.) [$\frac{1}{4}$ grain (0.01 Gm.), U. S. P.].

Fluidextractum Cannabis Indicae—**Fluidextracti Cannabis Indicae**—**Fluid-extract of Indian Cannabis.**—*Dose*, 2–5 minims (0.12–0.3 Cc.).

Tinctura Cannabis Indicae (10 per cent.)—**Tinctura Cannabis Indicae**—**Tincture of Indian Cannabis.**—*Dose*, 5–20 minims (0.3–1.2 Cc.).

Antagonists and Incompatibles.—Strychnine, caustic alkalis, acids, and aqueous preparations are pharmaceutical incompatibles, precipitating the resin.

Synergists.—Alcoholics, ether, bromides, cocaine, and members of the present group enhance its cerebral effects.

Physiological Action.—*Externally and Locally.*—Its local action on the skin is *nil*.

Internally.—Digestive System.—It is slightly sedative to the stomach, in many persons appearing to promote the appetite and aid digestion. Its use is not followed by constipation or other gastro-intestinal disturbance.

Circulatory System.—A slight acceleration of the pulse is noticeable under full doses.

Nervous System.—In moderate-sized doses after half to one hour there is a marked stimulation of the cerebral activities. The flow of ideas is heightened. Imagination is quickened and in certain types of individuals there may be hallucinations of sight, of hearing, of touch, etc. These are for the most part accompanied by a dreamy state of beatitude, atypical euphoria, comparable in some degree to the euphoria of alcohol or opium. Certain psychological peculiarities are often noted in the mental exaltation. Double consciousness, or sense of divided consciousness, is common, and there is usually a loss of space and time relations. The peripheral nerves of touch and pain are affected, both of these sensations being dulled. There may be heightened reflex irritability in the cord.

Respiratory System.—No marked or uniform action upon the respiration has been observed, it being at times quickened and again retarded.

Absorption and Elimination.—Cannabis is slowly eliminated, though in what manner is unknown, the effects of the drug sometimes persisting for twenty-four or thirty-six hours. Of all the secretions, the urine alone is affected, the amount being increased.

Temperature.—Cannabis has no direct depressing action upon temperature, which, however, may rise during the period of excitation, and be diminished somewhat during sleep.

Eye.—The drug differs from opium in that it dilates the pupil and produces exaggerated vision.

Uterus.—It is considered to be a powerful uterine stimulant, and like properties are usually ascribed to it as an aphrodisiac, though its effect upon sexual desire is not always manifest. It undoubtedly increases the energy of the uterus, though possessing no power to inaugurate uterine contractions when once suspended.

Poisoning.—Large doses of cannabis Indica are wont to produce toxic effects, but these are rarely fatal even in large doses. Cardiac failure is thought to precede respiratory paralysis.

The after-effects of hashish indulgence vary with the physiological and mental peculiarities of the individual. As a rule, they are not disagreeable, though it requires time to eradicate the effects of the poison. Death directly attributable to the drug has not been recorded.

Treatment of Acute Poisoning.—Among antidotes, lemon-juice, coffee, and tobacco have been favorably mentioned. The best treatment appears to be similar to that adopted in cases of chloral- and opium-poisoning.

Chronic poisoning induces a characteristic series of mental symp-

The effects of continued indulgence, according to the

Makhzan-el-Adwiya, an early treatise, are "weakness of the digestive organs, followed by flatulency, indigestion, swellings of the limbs and face, changes in complexion, diminution of sexual vigor, loss of teeth, heaviness, cowardice, depraved and wicked ideas." The most common effect, however, is the development of insanities which have been known for many years. A number of types are described. Temporary intoxication is the state commonly seen in the hashish cafés of the Orient. The patient represents a medium condition between an alcoholic and an opium intoxication. Hashish delirium represents a severer grade comparable to delirium tremens. The patients are restless and sleepless and chatter unendlessly. Acute maniacal excitement is also found. The patient runs amuck, but may also be melancholic. Chronic mania and dementia represent terminal stages. The mania is usually a happy mania. The dementia is of a classical organic type. A further form of the cannabis-mania needs characterization. He is the shiftless never-do-well—a liar and thief, quite comparable with the degenerated alcoholic, opium, or cocaine habitués.

Therapeutica.—*Externally and Locally.*—Cannabis is very seldom used locally.

Internally.—Cannabis has been discarded as a remedy in many disorders for which it was formerly used. It is, however, still employed to a considerable extent as a hypnotic in *melancholia* and *mania* and for its analgesic action in *neuralgia* and *pruritus*.

Cannabis Indica is of service in functional *impotence*, its action in this disorder being aided by combining it with ergot and nuxvomica.

It is a valuable adjuvant to cough-mixtures intended to relieve *tickling* or irritation of the throat, as well as to quiet the excessive cough of *bronchitis* or *phthisis*, being superior to opium in this respect, since it disturbs the stomach less and does not produce constipation.

It has been used in *spasm of the bladder*, and in *gonorrhea* and *chorda* it has been found to be a most valuable remedy.

In considering the therapeutics of cannabis Indica reference should be made to its efficacy in *migraine* and *headache*, particularly those present at the menopause. Although as a remedy for the former disorder cannabis has been largely superseded by the adoption of antipyrine and agents of its class, the old use of tincture of gelsemium, combined with tincture of cannabis, serves an important purpose in aborting the distressing attacks of *migraine*. It is useful as a mild hypnotic in insomnia from exhaustion with pain, and is often efficient in severe *tic douloureux*.

Administration—The extract should be given in pill form; the tincture and fluidextract, in an alcoholic menstruum. As has been already intimated, different samples vary greatly in strength; it is therefore best to begin with the minimum dose until the force and quality of the preparation be ascertained.

It is advisable to prescribe invariably the preparations of that

particular manufacture which experience has shown to produce samples of uniform strength.

THE MYDRIATIC NARCOTICS.

Because of their narcotic properties, utilized clinically in the treatment of diseased conditions, the following drugs are included in this subdivision of Narcotics. The most important are belladonna, hyoscyamus, and stramonium. They belong to one family of plants, the *Solanaceæ*, and contain active principles—alkaloids—that are very closely related. On account of their characteristic action on the pupil, these drugs are called mydriatics. These active principles, moreover, are confined closely to this family. These alkaloids all contain a tropin nucleus, which is a modified pyridine (a piperidine) to which acid groups are attached.

The tropin base is of particular interest as a starting-point from which these alkaloids can be synthetically constructed. Hyoscyamine is thought to be isomeric with atropine. Hyoscine (scopolamine) is closely related, but probably differs slightly. The composition of these and other related alkaloids is still in dispute. (Some of these are *Duboisine*, *Mandragorine*, *Daturine*, *Atropamine*, *Belladonnine*, *Bellatropine*, *Atroscine*, etc.).

The different plants of this group are: *Atropa Belladonna*, *Hyoscyamus niger*, *Datura Stramonium*, *Datura alba*, *Atropa mandragora*, *Scopola carmelica*, *Scopola japonica*, *Duboisia myoporoides*, and *Anisodus luridus*. Only the more important will be here considered.

Belladönnæ Fölia—Belladönnæ Foliörum—Belladonna Leaves. U. S. P.

Definition.—The dried leaves of *Atropa Belladonna* L., yielding when assayed not less than 0.35 per cent of mydriatic alkaloids.

Atropa Belladonna is a nearly glabrous, herbaceous, perennial plant, from 4 to 6 feet (1.2-1.8 M.) high, bearing dark-purple, bell-shaped flowers and shining purplish black berries of the size of a cherry. It is found in the woods, chiefly in the mountainous districts, of Central and Southern Europe, and as far east as Asia Minor, Caucasus, and Central Asia. It is cultivated in Europe and in the United States to some extent, being known by the common name of "deadly nightshade."

Description and Properties.—The leaves are from 4 to 6 inches (10-15 Cm.) long and about one half as broad, broadly ovate, equilaterally narrowed into a petiole, tapering at the apex, entire on the margin, smooth, thin, the upper surface brownish green, the lower surface grayish green, both surfaces whitish punctate, odor slight, taste bitterish and disagreeable.

Belladonna leaves contain from 0.2 to 0.6 per cent of *atropine*, the most important alkaloid, *belladonnine* (probably anhydrotropine), besides an alkaloid practically identical with *hyoscyamine* and chrysanthropic acid.

Dose.—1.5 grains (0.06-0.30 Gm.) [1 grain (0.065 Gm.), U. S. P.]

Official Preparations.

Extractum Belladönnæ Foliörum—Extracti Belladönnæ Foliörum—Extract of Belladonna Leaves.—**Dose,** $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.008-0.048 Gm.) [$\frac{1}{4}$ grain (0.1 Gm.), U. S. P.].

Emplastrum Belladonnæ (30 per cent.)—**Emplastrum** (acc.) **Belladonnæ**—**Belladonna Plaster**.—For external use. Should contain not less than 0.38, nor more than 0.42, per cent. of mydriatic alkaloids.

Formula: Extract of belladonna leaves, 300; adhesive plaster, 700.

Tinctura Belladonnæ Foliorum (10 per cent.)—**Tinctura Belladonnæ Foliorum**—**Tincture of Belladonna Leaves**.—**Dose**, 5-20 minims (0.3-1.2 Cc.) [8 minims (0.5 Cc.), U. S. P.]

Unguentum Belladonnæ (10 per cent.)—**Unguenti Belladonnæ**—**Belladonna Ointment**.—For external use.

Formula: Extract of belladonna leaves, 10; diluted alcohol, 5; benzoated lard, 65; hygroscopic wool fat, 20.

Belladonnæ Rādx—Belladonnæ Rādicis—Belladonna Root. U. S. P.

Description and Properties.—The dried root of *Atropa Belladonna*, yielding when assayed not less than 0.5 per cent. of mydriatic alkaloids. The root occurs in cylindrical, tapering, longitudinally wrinkled pieces, $\frac{1}{2}$ to 1 inch (12-25 Mm.) thick; externally brownish gray, internally whitish; fracture nearly smooth and mealy, not radiating or showing medullary rays in the thicker roots, except in the layer near the bark, nearly odorless, of sweetish taste, afterward bitterish and strongly acid.

The root contains the same constituents as the leaves, with the exception of chrysotropic acid, which is wanting, and in addition a red coloring principle, *atropin*, found also in the berries. Young roots have been found to contain proportionately higher percentages of hyoscyamine. The unripe berries contain hyoscyamine, while the process of ripening seems to either convert this alkaloid into atropine or larger quantities of atropine are conveyed to the berries at ripening.

Official Preparations.

Fluidextractum Belladonnæ Rādicis—Fluidextracti Belladonnæ Rādicis—Fluidextract of Belladonna Root.—**Dose**, 1-3 minims (0.06-0.18 Cc.) [1 minim (0.05 Cc.), U. S. P.].

Linimentum Belladonnæ (95 per cent.)—**Linimenti Belladonnæ**—**Belladonna Liniment**.—For external use.

Formula: Camphor, 50; fluidextract of belladonna root, 950.

Atropina—Atropinæ—Atropine. U. S. P.

Definition.—An alkaloid obtained from *Atropa Belladonna* and from other plants of the same family.

Description and Properties.—White acicular crystals, or a more or less amorphous white powder, odorless, having a bitter, acid taste, gradually assuming a yellowish tint on exposure to air. As it occurs in commerce, it is usually accompanied by a small amount of hyoscyamine. Soluble in 130 parts of water, 5 parts of alcohol, 16 parts of ether, 4 parts of chloroform, and about 50 parts of glycerin.

Dose.— $\frac{1}{16}$ - $\frac{1}{8}$ grain (0.0005-0.0016 Gm.) [$\frac{1}{16}$ grain (0.0004 Gm.), U. S. P.].

Official Preparations.

Atropinæ Sulphas—Atropinæ Sulphatis **Atropine Sulphate. U. S. P.**—

Description and Properties.—A white, indistinctly crystalline powder, odorless, having a very bitter, nauseating taste, permanent in air. Soluble in 0.4 part of water, 0.2 parts of alcohol, 2270 parts of ether, and 644 parts of chloroform. It is usually mingled with a small amount of hyoscyamine sulphate.

Dose.— $\frac{1}{16}$ - $\frac{1}{8}$ grain (0.0005-0.0016 Gm.) [$\frac{1}{16}$ grain (0.0004 Gm.), U. S. P.].

Oleatum Atropinæ—Oleum Atropinal—Oleate of Atropine, U. S. P.—Containing 2 per cent. of atropine.

Homatropinæ Hydrobrōmidum—Homatropinæ Hydrobrōmidi—Homatropine Hydrobromide.

Definition.—The hydrobromide of an alkaloid obtained by the condensation of tropine and mandelic acid.

Atropine may be broken up, by the action of alkalis, into an alkaloid, tropine, and an aromatic acid, tropic acid. Tropine forms ester like compounds with many acids; the compounds with aromatic acids are called tropeins. Homatropine is one of these tropeins, formed by the union of tropine and mandelic acid, the latter is phenylglycolic acid $C_6H_5CH_2 \cdot \begin{pmatrix} OH \\ COOH \end{pmatrix}$. Tropic acid (the acid of atropine) is phenylhydracrylic acid. $\begin{pmatrix} CH_2OH \\ COOH \end{pmatrix}$. Scopolamine (hyoscyne) is formed by the union of tropic acid with scopoline, a compound similar to tropine.

Properties.—Small, colorless, odorless, rhombic crystals or crystalline powder, having a bitter taste. Soluble in 5.2 parts of water and 32.5 parts of alcohol. It should be kept in well stoppered vials protected from light.

Dose.—“Average dose: 0.0005 gm. = 0.5 milligramme (1/11 grain)” U. S. P.

Euphthalmin is a recently introduced mydriatic, having a physiological action very similar to homatropine; it is a mandelic acid derivative of *Beta eucaine*.

Antagonists and Incompatibles.—Muscarine antagonizes the action of belladonna in nearly every particular, and physostigmine, pilocarpus, and aconite counteract many of its effects. Opium antagonizes its action on the cerebrum, pupil, heart, respiration, arterial tension, and kidneys.

Atropine is incompatible with caustic alkalies, tannin, and vegetable infusions containing tannin, an insoluble tannate of the alkaloid being formed.

Synergists.—The mydriatic drugs mentioned aid the action of belladonna.

Physiological Action.—The action of belladonna is dependent upon the amount of atropine it contains.

Externally and Locally.—When locally applied atropine is analgesic, antispasmodic, antisecretory, and mydriatic. When thus used, in combination with absorbable substances—such as alcohol, camphor, animal fats, glycerin, etc.—it diminishes the sensibility of the sensory nerves, and when absorbed from raw surfaces of the skin or from the subcutaneous tissue it is capable of producing systemic effects.

Internally.—Digestive Symptom.—Even small doses produce dryness of the mouth, owing to the greatly diminished secretion of saliva and mucus. The salivary secretion is lessened through paralysis of the peripheral endings of the secretory fibers only of the chorda tympani nerve in the submaxillary gland.

The drug diminishes the secretions from the stomach, liver, pancreas, and intestines possibly in a similar manner. The sweat is diminished through paralysis of the peripheral nerve-endings in the sudoriparous glands. The secretion of milk is reduced by paralysis of the peripheral terminations of the secretory nerves in the mammary glands. The secretion from the bronchial mucous membranes is lessened through the depressing influence of the drug upon the nerve-endings. The secretions of the kidneys are not as profoundly altered as are other glandular products.

Atropine is absorbed readily. It breaks up into tropin and tropic acid and has a marked action on the nervous structures.

Unstriped Muscles.—The peristaltic movements of the intestines are generally decreased by atropine. Very large doses are known at times to cause violent peristalsis and thus are thought to be of value in intussusception.

Circulatory System.—Medicinal doses of atropine or belladonna at first retard the pulse, due, it is thought, to a stimulation of the vagus centers, thus inhibiting the action, but it is quickly accelerated and rendered firmer with increased arterial pressure. The primary transitory action is due to a slight stimulation of the vagi roots, the subsequent quickening of the pulse resulting from paralysis of the peripheral ends of the pneumogastric nerve distributed in the cardiac muscle. The inhibition being thus removed, the heart responds to the influence of the accelerator nerves. The center for these nerves in the medulla is also stimulated by the drug, increasing still further the rapidity of the heart's action. The cardiac muscle itself, being stimulated, renders the contractions of the heart more forcible.

Arterial tension is increased not only by the greater rapidity and force of the heart, but also by the contraction of the arterioles arising from stimulation of the vasomotor center. Very large or poisonous doses lower arterial pressure. This effect is produced by exhaustion of the vasomotor center from over-stimulation, resulting in dilatation of the cutaneous arterioles, which lowers arterial tension and flushes the skin. Overwhelming doses may weaken the cardiac muscle itself from over-stimulation, weakening the heart's contraction, as well as paralyzing the terminal nerve-filaments in the muscles of the vessel-walls, and even the muscular fibers.

Nervous System.—A full medicinal dose of belladonna stimulates the brain, while large doses—and, in susceptible persons, medicinal ones—may produce hallucinations and delirium, accompanied by spectral illusions. The delirium may be mild, joyful, and talkative, or it may assume a violent type. It may, moreover, persist for a long time, after which the patient sinks to sleep, induced either by exhaustion from the delirium or a secondary depressing action of the drug. The motor area is also stimulated.

The spinal cord shares in the stimulation caused by belladonna. The reflexes are at first slightly exaggerated, being afterward diminished. Very often under poisonous doses there is complete motor paralysis, the loss of power occurring first in the lower extremities.

The sensory nerves are depressed, especially when the drug is locally applied, the influence being exerted on their terminal filaments.

Respiratory System.—Medicinal doses quicken and deepen the respirations, owing to stimulation of the respiratory center.

Poisonous doses over-stimulate, and consequently exhaust or

paralyze, the respiratory center, the result being slow and shallow breathing and death from asphyxia.

Absorption and Elimination.—Atropine is rapidly absorbed and eliminated, chiefly by the kidneys, but also to some extent by the bowels. It is thought that part of the drug is oxidized by the liver.

Temperature.—Large doses slightly increase bodily heat, probably by increasing the circulation and respiration, consequently augmenting combustion. Ott maintains that belladonna stimulates the heat-center. In cases of severe poisoning from the drug the temperature rapidly falls.

Eye.—Belladonna dilates the pupil, whether locally applied or taken internally. The manner in which atropine dilates the pupil has not yet been satisfactorily explained, the prevailing opinion being that the action is due to a paralysis of the peripheral ends of the oculomotor nerves. The dilatation may be rendered greater by stimulation of the cervical sympathetic, but the fully dilated pupil is irresponsive to light and accommodation.

Atropine increases intraocular tension, rendering it a dangerous drug in glaucomatous conditions.

Untoward Action.—Very frequently there appears, especially in children, an erythematous or scarlatinal eruption, oftener noticeable on the face and neck, but sometimes affecting the entire surface of the body. Redness and pain in the throat may also be present, but no fever, with itching of the skin or desquamation.

Occasionally instillation of atropine into the eye produces profuse lachrimation, edema of the eyelids, and blepharo-conjunctival irritation.

When taken internally in medicinal doses it sometimes occasions in certain persons vertigo, turgescence of the face, hallucinations, erethistic debility, and impaired assimilation.

Homatropine has caused dizziness, uncertainty of gait, fatigue, difficulty in deglutition, and loquacious delirium.

Poisoning.—The poisonous actions of belladonna may be summarized as follows:

The skin is dry and hot; the conjunctivæ are congested, with, possibly, edema of the eyelids, and pupils widely dilated; the heart action becomes rapid after ten to fifteen minutes; the face is swollen, while the whole body may be covered with an erythematous rash, and there is a sensation of heat and pain in the throat and difficulty in swallowing. These symptoms usually develop in from fifteen to twenty minutes.

Rapid respirations, muscular weakness, and incoördination of movements appear; the patient becomes dizzy or mildly or violently delirious, continually talking, shouting, or laughing. While there is a constant desire to micturate, there is an inability to pass any urine. At this stage the respirations are slow and shallow. Finally, convulsions may occur, and the patient sink into a comatose condition and die from asphyxia and cardiac exhaustion.

A lethal dose of atropine has been for an adult 0.15 gm. (2.5 grs.) and for a three-year-old child 0.01 gm. ($\frac{1}{8}$ gr.). The mortality

is not high, being stated by Kionka to be about 11.6 per cent. This was the figure of Feddersen in his dissertation study (Berlin) of 103 reported cases from 1880 to 1882. It is of interest to note that a fatal case is reported from the application of a plaster containing 0.18 gm. of atropine to 8 gm. fat (3 gr.). In fatal cases death takes place in from six to eight hours, sometimes as late as eighteen to twenty hours.

Treatment of Poisoning.—Wash out the stomach with solutions of tannic acid, pursuing the treatment with the cautious administration of physostigmine, morphine, or small doses of pilocarpine. Should cardiac failure be pronounced or the patient lapse into a state of stupor, stimulants and the subcutaneous injection of caffeine are indicated, the patient being aroused meanwhile and kept awake, if possible, respiration being maintained by the use of strychnine and by artificial means when necessary. Should the temperature fall below normal, external heat must be applied. It is usually advisable to empty the bladder by means of a catheter.

ATROPINE COMPARED WITH MORPHINE.

Atropine stimulates respiration; morphine is a powerful respiratory depressant. Atropine dilates the pupil; morphine contracts it. Atropine increases bodily heat, and frequently reddens the surface of the skin; morphine produces pallor of the skin and lowers temperature.

Both drugs lessen peristaltic action of the bowels in moderate doses. Atropine reinforces the functional activity of the kidneys; morphine lessens it. On the other hand, atropine checks the secretion from the skin, while morphine increases it.

The remaining secretions are diminished by both drugs, but in different ways.

Atropine acts rather as a cerebral excitant, producing delirium, hallucinations, and disturbed sleep; morphine is more of a cerebral depressant, the period of mental excitation being comparatively brief, while sleep is longer and more profound.

In many respects these drugs are mutually synergistic. Both relieve pain, though morphine is much the more powerful anodyne. Both cause incoordination of muscular movements and mental confusion.

Although in many respects antagonistic, they are frequently combined when an anodyne action is desired. As has been forcibly suggested, their reciprocal influence, when administered together, modifies in a remarkable manner their physiological effects.

Therapeutics.—The many uses for which belladonna has been employed would render it a difficult, perhaps useless, task to enumerate them. As in the case of opium, there are certain general and important actions in disease which the physician can utilize in daily practice, a succinct mention of which is appended:

1. BELLADONNA IS SERVICEABLE IN RELAXING SPASMS OF INVOL-

UNTARY MUSCLES, as in *asthma*, *spasmodic colic*, *lead colic*, *spasmodic dysmenorrhea*, *laryngismus stridulus*, etc.

2. In DIMINISHING SECRETION, as in *acute coryza*, *bronchitis*, *night-sweats of phthisis*, and to check the secretion of milk, *mercurial ptyalism*, etc.

3. In RELIEVING PAIN, either combined with opium or morphine, or alone, particularly where it can be applied locally, as in *lumbago*, *neuralgia*, *pleurodynia*, etc.

4. Belladonna is used to STIMULATE THE CIRCULATORY SYSTEM in cases of a weak heart and low arterial tension, as in *fevers*, etc.

5. For ITS PECULIAR ACTION UPON THE EYE IN OPHTHALMOLOGICAL PRACTICE, to dilate the pupil, prevent adhesion, remove congestion, relieve pain, and afford rest.

While, as has been said, it is impossible to discuss in detail the manifold uses of belladonna, its more important therapeutic services may be here mentioned:

Externally and Locally.—Belladonna ointment is useful in the treatment of *boils*, *carbuncles*, *chronic inflammatory conditions about the articulations*, *chronic synovitis of the knee-joint*, its efficiency in the latter condition being enhanced by combining it with mercurial ointment. *Orchitis* is greatly relieved by covering the testicle with belladonna ointment. Suppositories containing extract of belladonna are beneficial in the treatment of *hemorrhoids*, and in *anal fissure*.

Eczema and excessive sweating of certain areas of the skin, such as the palms and soles, are benefited by a local application of the tincture or the dried and powdered extract mixed with some inert desiccant powder like powdered talcum.

Belladonna plaster is one of the most useful applications in cases of *acute or chronic muscular rheumatic pains*, and in forms of *neuralgia*. In its power to arrest the secretion of milk the drug is perhaps without an equal.

Internally.—Belladonna is combined with opium to relieve the pain of *gastralgia* and *enteralgia*, while its combination with strychnine and iron is useful in *anemic neuralgia*.

Nocturnal incontinence of urine in children, when resulting from supersensitiveness of the mucous membrane of the bladder, derives signal benefit from the drug.

Belladonna combined with strychnine stimulates the respiration and checks the sweating in *phthisis*. A similar union with some laxative drug makes an exceedingly useful pill in *habitual constipation*, while the *obstinate constipation due to lead-poisoning* is greatly relieved by belladonna.

This drug, as well as the other mydriatic narcotics, is one of the most reliable remedies we possess to relieve the symptoms of *spasmodic asthma*. It is highly recommended also by many physicians in *typhoid fever* to support the circulation and relieve many distressing symptoms of the disease. In *scarlatina*, too, it is thought to be a useful remedy. It is useful in *whooping-cough*.

Cardiac pain and distress due to over-action of the heart are alleviated by the application of belladonna plaster over the cardiac region or by the internal use of the drug.

Intestinal, hepatic, and renal colic, cystitis, prostatitis, spermatorrhea, exophthalmic goiter, cerebral and spinal hyperemia, sea-sickness, facial erysipelas, and menorrhagia have all apparently been favorably influenced by belladonna.

Atropine subcutaneously injected is a powerful antidote to *chloroform-, physostigma-, morphine-, aconite-, and jaborandi-poisoning*, as well as that contracted from muscarine or phallin containing mushrooms.

Administration.—The crude drug, leaves, and root are seldom if ever used. Owing to its action in diminishing secretion, it is better to time the internal administration of belladonna so as to interfere as little as possible with the process of digestion.

Atropine is more certain in its action than any of the preparations of the crude drug. In all cases it is best to administer atropine by the intensive method. A granule containing gr. $\frac{1}{1000}$ may be given to an adult, best in solution, every twenty to thirty minutes, according to the urgency of the case, until the first evidence of action is manifest. This is almost invariably dryness of the mouth; only exceptionally do any of the classic symptoms precede this. When this dryness is felt it is time to stop the drug. Children are peculiarly insusceptible to this drug, sometimes tolerating as large doses of the tincture as adults.

When atropine is used hypodermically in cases of sciatica or neuralgia, the injection should be made deeply in close proximity to the affected nerve-trunk.

The part of the body to which a belladonna plaster is to be applied should be first thoroughly cleansed and dried, the exact area to be covered being specifically designated by the physician. Caution should be exercised in the application, lest too large a space be covered by the plaster, and dangerous symptoms supervene from absorption of its more active constituents, a result which may also occur from too prolonged contact, from three to five days being usually sufficient. Should it be desirable to continue the influence of the drug, the application of fresh plaster from time to time will produce better results than too long use of a single one.

Hyoscyamus—Hyoscyami—Hyoscyamus. U. S. P.

(HENBANE.)

Origin—The dried leaves and flowering tops of *Hyoscyamus niger* L., collected from plants of the second year's growth, and yielding, when assayed, not less than .08 per cent. of moderate alkaloids. Henbane is a biennial growing in sandy soil and waste places throughout the greater portion of Europe and Asia, and naturalized in North America.

Description and Properties—Leaves ovate or obovate oblong, up to 10 inches .75 Cm. long and 1 inch .5 Cm. broad, sinuate toothed, the teeth large, oblong, or triangular, grayish green, and, particularly on the lower surface, glandular.

hairy; midrib prominent; flowers nearly sessile, with an urn-shaped, five-toothed calyx and a light yellow, purple-veined corolla; odor heavy, narcotic, taste bitter and somewhat acrid.

The active constituents are *hyoscyamine* and *hyoscyne* (scopolamine), and a very poisonous volatile oil is obtained by distillation of the leaves, which contain also a small percentage of potassium nitrate. It is important to bear in mind that the modern hyoscyamine is distinct from the impure mixture of hyoscyne and hyoscyamine previously designated hyoscyamines.

Dose of the Leaves.—5-15 grains (0.3-1.0 Gm.) [4 grains (.250 Gm.), U. S. P.].

Official Preparations.

Extractum Hyoscyami—Extracti Hyoscyami—Extract of Hyoscyamus.—*Dose*, 1-3 grains (0.06-0.2 Gm.) [1 grain (0.065 Gm.), U. S. P.].

Fluidextractum Hyoscyami—Fluidextracti Hyoscyami—Fluidextract of Hyoscyamus.—*Dose*, 5-15 minims (0.3-1.0 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Tinctura Hyoscyami—Tincturæ Hyoscyami—Tincture of Hyoscyamus (10 per cent).—*Dose*, 10-60 minims (0.6-4.0 Cc.) [30 minims (2 Cc.), U. S. P.].

Hyoscinæ Hydrobrômidum—Hyoscinæ Hydrobrômidi—Hyoscyne Hydrobromide (U. S. P.).—*Origin*.—The hydrobromide of an alkaloid, chemically identical with scopolamine, obtained from hyoscyamus and other plants of the *Solanaceæ*.

Description and Properties.—Colorless, transparent, rhombic crystals, odorless, and having an acrid, slightly bitter taste, permanent in the air. Soluble in 15 parts of water and in 10 parts of alcohol at 25° C. It should be kept in small, well stoppered vials.

Dose.— $\frac{1}{10}$ — $\frac{1}{2}$ grain (0.0006-0.003 Gm.) [$\frac{1}{2}$ grain (0.005 Gm.), U. S. P.].

Hyoscyaminæ Hydrobrômidum—Hyoscyaminæ Hydrobrômidi—Hyoscyamine Hydrobromide (U. S. P.).—*Origin*.—The hydrobromide of an alkaloid obtained from hyoscyamus and other plants of the *Solanaceæ*.

Description and Properties.—Yellowish white, amorphous, resin-like masses or prismatic crystals, having, particularly when damp, a tobacco-like odor and an acrid, nauseous, and bitter taste. Deliquescent on exposure to the air; soluble in about 0.3 part of water and 2 parts of alcohol. It should be kept in small, well stoppered vials.

Dose.— $\frac{1}{10}$ — $\frac{1}{2}$ grain (0.0006-0.003 Gm.) [$\frac{1}{2}$ grain (0.005 Gm.), U. S. P.].

Hyoscyaminæ Sulphas—Hyoscyaminæ Sulphatis—Hyoscyamine Sulphate (U. S. P.).—*Origin*.—The neutral sulphate of an alkaloid obtained from hyoscyamus and other plants of the *Solanaceæ*.

Description and Properties.—White, indistinct crystals or a white powder, without odor, and of a bitter, acid taste, deliquescent in damp air. Soluble in 0.5 part of water and 0.4 parts of alcohol at 25° C. It should be kept in small, well stoppered bottles.

Dose.— $\frac{1}{10}$ — $\frac{1}{2}$ grain (0.0006-0.003 Gm.) [$\frac{1}{2}$ grain (0.005 Gm.), U. S. P.].

Scopöla—Scopöläe—Scopola. U. S. P.

Definition.—The dried rhizome of *Scopola Carmichaelia*, Jacquin. Scopola is closely related to belladonna and hyoscyamus.

The Pharmacopœia demands that the drug contain not less than 0.5 per cent. of alkaloids; it is assayed by the same process as are belladonna leaves.

Dose.—Average dose—0.045 Gm. = 45 minigrammes ($\frac{1}{2}$ grain). U. S. P.

The alkaloid of scopola is almost wholly hyoscyne. The content of the alkaloids of scopola is remarkably uniform (about 0.55 per cent.), whereas the percentage of alkaloids in belladonna varies from 0.2 to above 1 per cent.

Official Preparations.

Scopolaminæ Hydrobrômidum—Scopolaminæ Hydrobrômidi—Scopolamine Hydrobromide (U. S. P.). *Definition*.—The hydrobromide of an alkaloid, $C_{17}H_{21}NO_4 \cdot HBr + 3H_2O$, obtained from plants of the *Solanaceæ*; chemically identical with hyoscyne hydrobromide.

Although hyoscyne hydrobromide, which was admitted into the U. S. Pharmacopœia, 1890, and scopolamine hydrobromide are identical, both names are used in the U. S. Pharmacopœia, Eighth Decennial Revision, as separate headings, because physicians are

more familiar with the name hyoscine than with scopolamine. Scopolamine is formed by the union of tropic acid and scopoline, a compound similar to tropine (See Hom atropine.)

Dose.—Average dose: $\frac{1}{4}$ grain (0.0005 Gm. = 0.5 milligramme), U. S. P.

Extractum Scopolæ.—*Extracti Scopolæ*.—Extract of Scopolia (U. S. P.).

The U. S. Pharmacopœia demands that the extract of scopolia contain 2 per cent. of mydriatic alkaloids, for method of assay see Pharmacopœia.

Dose.—Average dose: $\frac{1}{4}$ grain (0.010 Gm. = 10 milligrammes), U. S. P.

Fluidextractum Scopolæ.—*Fluidextracti Scopolæ*.—Fluidextract of Scopolia (U. S. P.).—Prepared from scopolia (*y. t.*) and containing 0.5 per cent. of the mydriatic alkaloids of this drug.

Dose.—Average dose: 1 minim (0.05 Cc.), U. S. P. This dose contains $\frac{1}{4}$ grain (0.0005 Gm.) of the scopolia alkaloids.

Antagonists, incompatibles, and synergists the same as for belladonna.

Physiological Action.—The action of hyoscyamine is analogous to that of belladonna, with the following difference: (1) It shows more cerebral depression, as a rule, than does atropine. Excitement is, however, by no means infrequent.

(2) Pure hyoscyamine is thought to act more strongly on the heart, pupils, and sweat glands than atropine. Others deny this. According to Merck, there is absolutely no difference between atropine and hyoscyamine. Cushny says that while the resemblance is very close, there are differences. The consensus of clinical experience, however, seems to be that, while hyoscyamine closely resembles atropine, the former is milder in action.

(3) As for hyoscine (scopolamine), the action is quite different. Hyoscine is a distinct hypnotic. It depresses the cerebrum. Whether this depression is analogous to the depression of atropine with a very slight or no preliminary stimulation is not yet known. It is not improbable that hyoscine may be regarded as causing a more profound coma with less of the other effects of atropine. In its action on the peripheral nervous system it very closely resembles atropine in its action, being perhaps more powerful. Profound collapse has occurred from its use in disease with rapid and feeble pulse. The action in the medulla does not seem to be as stimulating as is that of atropine.

Untoward action, poisoning, and treatment of poisoning are the same as for belladonna.

Therapeutics.—HYOSCYAMUS may be used for the same purposes as belladonna, but is considered superior to the latter drug as a urinary sedative in the treatment of *incontinence of urine, vesical tenismus, cystitis, prostatitis*, etc.

For the relief of *colic of various forms*, and to *allay the griping* produced by certain purgatives, hyoscyamus is better than belladonna.

In mental disorders it is useful in any maniacal state. In convulsive disorders, *hysterical convulsions, chorea, paralysis agitans*, etc., hyoscine is valuable. It has been recently advocated as a hypnotic in the treatment of the *morphine habit*.

Hyoscyamine has been found useful in aggressive *mania*, chronic

forms with hallucinations, subacute and recurrent mania, the irritative stages of *general paralysis*, and in *epilepsy*.

Hyoscyamus and its alkaloids are fully equal to belladonna in the treatment of *asthma*, *whooping cough*, *neuralgia*, *enteralgia*, etc.

As an anodyne and hypnotic for children hyoscyamus is frequently used. Hyoscyne and morphine have recently been used extensively as an anesthetic. Morphine—gr. $\frac{1}{4}$ (0.008 Gm.) to gr. $\frac{1}{2}$ (0.015 Gm.)—with hyoscyne—gr. $\frac{1}{16}$ (0.0006 Gm.)—is injected hypodermically, repeated in half or one hour if necessary, and again, when usually even a capital operation may be performed painlessly, or with the aid of the merest whiff of chloroform. This method of securing anesthesia is being widely tested and rapidly coming into favor in obstetrical practice.

Administration.—Like belladonna, this drug should be administered tentatively. Any of the preparations may be given. The salts of the alkaloids may be administered either subcutaneously or internally.

The hyoscyne is tasteless, and may be easily given in various drinks. When used internally its action is slower, but more prolonged, than when given hypodermically, though the dose under the former method should be twice that of the latter.

Stramōnium—Stramōnii—Stramonium. U. S. P.

(THORN-APPLE; JAMESTOWN OR JIMSON WEED)

Definition.—The dried leaves of *Datura Stramonium* L., yielding when assayed not less than 0.35 per cent. of hydrate alkaloids. Stramonium is a coarse-looking annual weed, believed to be a native of Asia, but found growing in waste places and along roadsides throughout the greater part of the world.

Description and Properties.—From 3 to 8 inches (7–20 Cm.) long, petiole, dark green, smooth, ovate, pointed, unequal, especially at the base, coarsely and sinuately toothed; thin, brittle, and nearly inodorous; taste unpleasant, bitter, and nauseous. Stramonium leaves contain about 0.2 per cent. of a mixture of atropine and hyoscyamine previously termed *scatarrine*.

Dose.—1–5 grains (0.06–0.3 Gm.).

Antagonists, incompatibles, and synergists are the same as for belladonna.

Physiological Action.—The action of stramonium is practically identical with that of belladonna. It is thought to contain larger amounts of hyoscyamine than belladonna, and will, therefore, have more of the action of that drug combined with the action of atropine.

Poisoning from the thorn apple is by no means uncommon. It is a ubiquitous weed, widely dispersed, and its seeds are frequently eaten by children. The *treatment* should follow the lines established for belladonna-poisoning.

Therapeutics.—The medical uses of belladonna are applicable to this drug, although stramonium is much more widely used in *spasmodic asthma*.

Administration.—No special directions are necessary, any of the preparations being serviceable. For *asthma* the leaves may be

smoked in a pipe or in the form of cigarettes, this method of employing the drug to relieve bronchial spasm being probably superior to internal administration.

MOTOR DEPRESSANTS.

The more classic of these motor depressants is curare, but conium, because of its more extended use in therapy, will be first considered. *Gelsemium*, a third member of the group, may be said in a general way to pertain to both the atropine-cocaine and the curare groups, as it shows characteristic reactions of both.

A large number of drugs may be spoken of as motor depressants—thus, the entire alcohol group reduce motor power, and many others, nicotine, aconite, etc., but it is preferred to group here only those in which the principal medical uses are to depress the motor mechanism and lessen reflex excitability.

Conium—Conii—Conium. U. S. P.

(SPOTTED HEMLOCK.)

Origin.—The fall grown but unripe fruit of *Conium maculatum* L., carefully dried and preserved, and yielding when assayed not less than 0.5 per cent. of conine. After being kept for more than two years conium is unfit for use. Spotted hemlock is a biennial indigenous herb, a few feet high, growing in the temperate regions of Asia, Europe, and Northern Africa, and naturalized in some portions of New England, New York, and South America. It grows in waste places and along streams.

Description and Properties.—About 1½ inch (3 Mm.) long, broadly ovate, laterally compressed, grayish green, often divided into two mericarps, each with five crenate ribs, without oil tubes, and containing a seed grooved on the face; odor and taste slight.

When triturated with solution of potassium or sodium hydrate conium gives off a strong disagreeable, mouse-like odor.

The most important constituent is a volatile liquid alkaloid, *conine*. It also contains methyl-conine, conhydrine, and its isomer pseudosconine. The volatility of the alkaloid is largely responsible for the varying composition of the preparations and the discordant therapeutic results.

Dose.—1-5 grains (0.06-0.3 Gm. [3 grains (2 Gm.), U. S. P.].

Official Preparation.

Fluidextractum Conii—Flüidextracti Conii—Fluidextract of Conium.—*Dose*, 1-5 minims (0.06-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.]

Conine is closely related to piperidine; its structural formula is that of propyl piperidine.

Antagonists and Incompatibles.—*Nux vomica* and its alkaloids, *cocculus* and *picrotoxin*, are antagonistic to conium. Tannic acid and the alkalis are chemically incompatible.

Synergists.—The motor depressants and morphine.

Physiological Action.—*Externally and Locally.*—Conine, the active principle of conium, has no effect upon the unbroken skin.

Internally.—Digestive System.—Conium increases the salivary secretion, and when taken into the stomach exerts no special action upon the digestive system other than an occasional disturbance of the gastro-intestinal tract, possibly resulting in vomiting and diarrhea under full dosage.

Circulatory System—Although when ingested coniine is rapidly absorbed by the blood, circulating in the system unchanged, its action is not clearly defined, though it has been held that the circulation is first accelerated and then retarded, with a lowering of arterial pressure preceded by a decided increase.

From its capacity to paralyze the vagi terminals it is natural to suppose that it increases the rapidity of the cardiac movements, yet a characteristic feature of the absorption of coniine is the apparent absence of cardiac derangement, the heart, as well as the mind, remaining unaffected in the presence of alarming symptoms.

Nervous System.—The action of coniine in the higher cerebral centers is very slight. In some patients a mild drowsiness has been observed, but, as a rule, consciousness and the thought processes are not modified, save in the final stages of asphyxiation. The action on the medulla is also slight.

Spinal Cord and Motor Ganglia.—The action on the cord is not determined. Slight twitchings and even convulsions are sometimes observed, but it is not positive that central irritation is the cause.

The characteristic action of conium is on the terminal end-plates in the voluntary muscles. These are paralyzed after a possible transitory stimulation. Some depression of motor-plates in involuntary muscles is also noted, particularly in the heart, but it is not as pronounced as in the plates of the voluntary muscles.

Respiratory System.—Large or poisonous doses may depress the respiratory center, but paralysis of the muscles of respiration is probably responsible for death rather than poisoning of the centers.

Absorption and Elimination.—The drug is readily absorbed. Elimination is rapid and takes place chiefly through the kidneys and lungs. Coniine has been detected in considerable quantities in the liver, lungs, and spleen.

Temperature.—It has been held that bodily temperature is perceptibly lowered by conium, proportionately with the extent of the paralysis occasioned. High authorities, however, assert an increase of temperature under both therapeutic and toxic doses.

Eye.—Heaviness of the eyelids, dilated pupils, accompanied by double or confused vision and occasionally entire loss of sight, have been noted among the symptoms incident to the administration of active dosage. The paralysis of the third nerve is probably responsible.

Poisoning.—A frequent symptom of conium-poisoning is ptosis, arising from paralysis of the oculomotor nerves. Staggering gait, general muscular relaxation, impairment of vision, nausea, and ver-

tigo are also not infrequent. The severer symptoms are marked by muscular paralysis of the extremities, derangement of vocal organs resulting in difficulty of speech, and dilatation of the pupils. The brain meanwhile remains unaffected until overcome by the accumulation of carbon dioxide gas in the blood, when delirium and coma may ensue, and finally cerebral convulsions and fatal collapse through respiratory failure. Doses of 2 gr. (0.15 gm.) conium have caused death within a half hour. Socrates is said to have died in 40 minutes after taking the poisoned cup.

Treatment of Poisoning.—The stomach should be evacuated by means of emetics or lavage, after which tannic acid and the physiological antidotes may be administered. Artificial respiration is practically the only expedient, as the paralyzed end-organs cannot physiologically respond to any drug irritation.

Therapeutics.—*Externally and Locally.*—Conium leaves applied as a poultice relieve pain somewhat, as in ulcers and carcinoma, but other and better local analgesics are at hand, and its use in this respect is limited.

It is very problematic whether conium has any well-marked therapeutic applications. If it is employed, it is absolutely essential that a very fresh specimen be used, since the active alkaloid is volatile. It is perhaps best to use a salt of the alkaloid or a salt of methyl-conium. On theoretical, as well as practical, grounds it can have little value in the involuntary spasmodic affections; it can only mask muscular movement, not modify the pathological impulses. In voluntary habit spasms, however, it has its only practical uses. Here it may prevent the accomplishment of a morbid muscle impulse, and thus with suggestive therapeutics be of service in the treatment of the habit "tics," habit spasms, etc., particularly in their early stages. When the brain path is firmly established conium is of little service.

Contraindications.—Conium should not be given to persons suffering from great exhaustion and debility or from diseases interfering with the rhythm of the heart.

Administration.—The preparations of conium are very unreliable, the assayed, or "standardized" fluid extract being perhaps the one to be depended upon most uniformly. Owing to the uncertainty of their strength, the administration should begin with small doses gradually augmented until interference with involuntary motion is observed, when further increase should be stopped.

The effects of the drug are weakened by repeated doses, rendering an increase in the dose necessary from time to time. Conium and morphine greatly aid each other, and this combination is a particularly efficient one in the treatment of painful muscular spasms and acute mania with excessive motor activity. Conium and sulphonal are of great value in insomnia accompanied by motor restlessness. (See Sulphonal.)

Curāre—Curāre—Curare (unofficial).

(WOORARI.)

Origin.—An extract of uncertain composition prepared by the natives of South America as an arrow poison. Dr. Jubbett reported to the French Academy in 1878 that the poison was prepared chiefly from *Strophanthus castelneana* and other species of *Strophanthus*, and *Coccoloba tigrina*, containing also variable quantities of other poisonous plants, such as *Delphinium*, *concolorata*, etc. It is altogether probable that its ingredients include the poison of venomous reptiles. Each tribe, however, has its own method for preparing curare, and the precise formulas are clan secrets. Böhm's studies in 1887 were among the first to give accurate details of the varieties, but these change from time to time.

Description and Properties.—The extract is a blackish brown, friable solid, brittle or hygroscopic, of a very bitter taste; almost completely soluble in dilute alcohol. Cold water dissolves about 75 per cent., which portion contains the poisonous alkaloids and is insoluble in ether and but sparingly soluble in absolute alcohol.

The active constituents vary somewhat. *Curarine* is the name given by Böhm to the alkaloid, or impure nitrogenous base, which produces the typical paralyzing effects of curare. Other alkaloids have been named *curin* and *pre-scurarine*, the former inert, the latter supposed to be very active. Böhm's studies have not been subjected to careful revision.

Dose.— $\frac{1}{32}$ — $\frac{1}{16}$ grain (0.003–0.03 Gm.), hypodermically given.

Dose of Curarine.— $\frac{1}{32}$ – $\frac{1}{16}$ grain (0.0003–0.0006 Gm.), hypodermically.

Antagonists and Incompatibles.—The excito-motors are antagonistic. Tannic acid and the caustic alkalis are chemically incompatible.

Synergists.—The depresso-motors.

Physiological Action.—When applied to the denuded skin it is an irritant.

Circulatory System.—Medicinal doses render the pulse fuller and rapid from vagus depression; there is marked dilatation of the blood-vessels of the skin and the various glands; while the blood-pressure, though little affected by small doses, is decidedly lowered by large ones. The ganglionic paresis causes the fall in pressure.

Nervous System.—No cerebral action is caused by moderate doses. The action on the medulla is slight in moderate dosage.

Spinal Cord and Peripheral Nerves.—The typical action of curare is on the end-plates of the motor nerves of striated muscles. These are paralyzed, the smaller muscles being first involved, hence ptosis, etc. The respiratory muscles are first acted on. Unstriated muscle terminations are not affected. Sensory nerves are unaffected. The peripheral ganglia of the sympathetic are paralyzed. The dilated pupil, the increased peristalsis, and involuntary evacuations are indications of this sympathetic nerve depression.

Respiratory System.—Curare is a powerful respiratory depressant, paralyzing the ends of the motor nerves distributed to the respiratory muscles. When lethal doses have been given, the paralysis may become central. Death results from asphyxia.

Curare is absorbed very slowly from the stomach and is probably little acted on in the body, as in animals most of it has been recovered from the urine.

Absorption and Elimination.—When ingested the process of

absorption is exceedingly slow, but when injected into the circulation the drug is rapidly absorbed.

It is quickly eliminated by the kidneys, causing sugar to appear in the urine. A portion of the poison is also excreted with the feces. The sweat, saliva, nasal mucus, and tears, although their secretion is greatly increased by the drug, do not seem to share in the process of elimination. Metabolism in general is checked.

Poisoning.—Curare is a rapid and active poison. The movements of the heart are greatly accelerated; the pulse is weak and dicrotic; the temperature is elevated, and the respiration correspondingly depressed; extreme muscular weakness ensues, with incoördination of movements; the urine becomes saccharine. Finally, paralysis of the extremities and the respiratory muscles supervenes, death occurring from respiratory paralysis.

Treatment of Poisoning.—The same as in the treatment of poisoning from conium, with catheterization of the bladder to favor elimination, and artificial respiration.

Therapeutics.—While of great scientific interest and of value for experimental purposes in ascertaining the effect of certain drugs upon animals, the therapeutic uses of curare are very limited. It is indicated only in those diseases for which conium has proved of some service.

Contraindications.—The same as for conium.

Administration.—The crude drug or the alkaloid *curare* should be given hypodermically.

Gelsēmium—Gelsēmii—Gelsemium. U. S. P.

(YELLOW JASMINE.)

Origin.—The dried rhizome and roots of *Gelsemium sempervirens* (L.) Pers., a plant indigenous in the southern United States, growing in moist woods.

Description and Properties.—Cylindrical, long or cut in sections about 1 inch (25 Mm.) in length, externally light yellowish brown, with purplish brown longitudinal lines; tough, fracture splintery; bark thin, with a few bast fibers closely adhering to the pale yellowish, porous wood, which has five medullary rays, and in the rhizome a thin pith; odor aromatic, heavy; taste bitter.

It contains two alkaloids, *gelsemine*, with an action on frogs resembling strychnine, and *gelsenamine*, which acts more like conium. The general effects are therefore blended, but gelsemine is the more potent alkaloid for man at least.

Dose.—2-10 grains (0.13-0.6 Gm.) (1 grain (0.065 Gm.), U. S. P.).

Official Preparations.

Fluidextractum Gelsēmii—**Fluidextracti Gelsēmii**—**Fluidextract of Gelsemium.**—*Dose*, 2-10 minims (0.12-0.6 Cc.) (1 minim (0.05 Cc.), U. S. P.).

Tinctūra Gelsēmii—**Tincturæ Gelsēmii**—**Tincture of Gelsemium.**—*Dose*, 15-60 minims (1.0-4.0 Cc.) (8 minims (0.5 Cc.), U. S. P.).

Gelsemina (unofficial). **Gelseminæ**—**Gelsemine.**—**Description and Properties.**—A brittle, solid, transparent, crystallizable mass, converted into a colorless liquid at 45° C. (113° F.). Insoluble in cold water, but soluble to a slight extent in hot water, as well as in alcohol; taste bitter.

Dose.—2-10 grains (0.0003-0.001 Gm.).

Antagonists and Incompatibles.—The cardiac and diffusible stimulants are antagonistic; tannic acid and caustic alkalis are incompatible, precipitating the alkaloid.

Synergists.—The motor depressants.

Physiological Action.—The action of gelsemium throughout resembles that of conium and curare very closely. There are certain points of difference, however, that render this drug much more valuable therapeutically than either of the others.

On the cerebrum, gelsemium shows a more pronounced depressing action, causing drowsiness and depression. As this is often a late symptom with large doses it may be due to beginning asphyxiation.

Gelsemium depresses the respiratory center more than does curare. It also has a classical peripheral action.

Gelsemium has a distinct action on sensory nerves. It is, therefore, useful in painful affections.

The heart action under medicinal doses of gelsemium is more apt to be slowed than quickened, as with the more powerful curare. This would seem to indicate less depression of the vagus. It has a pronounced effect on the sympathetic ganglia and is useful therapeutically in reducing blood-pressure.

Absorption and Elimination.—Gelsemium is speedily absorbed and readily excreted, chiefly by means of the kidneys. Untoward symptoms produced by immoderate amounts of the drug practically subside within three hours after ingestion.

Poisoning.—In toxic doses gelsemium is quickly fatal. The early symptoms include drooping of the eyelids, wide dilatation and immobility of the pupils, extreme muscular weakness, affecting first the muscles of the upper extremities, and incoordination of movements. Diplopia and dimness of vision may ensue, accompanied by difficulty of speech, coldness of the body surface, and general cutaneous anesthesia, with decidedly lower temperature. Meanwhile, there is marked diminution in the force of the heart and respiratory paralysis. Death has resulted from a teaspoonful of the fluid extract. $\frac{1}{2}$ gr. of gelseminine is given as a minimum lethal dose.

While the patient may be drowsy, the mind is unaffected until carbonic-acid narcosis supervenes. Death is usually the result of respiratory failure, due to paralysis of the muscles of respiration. **Paralysis of the heart also occurs.**

Treatment of Poisoning.—The evacuation of the stomach is of the first importance, either by the stomach-pump or by the use of emetics. Washing out with a solution of tannic acid is probably the best method to pursue. External heat should be applied and diffusible stimulants administered, followed by digitalis and strychnine. The hypodermic injection of morphine and atropine is highly recommended in gelsemium-poisoning. Artificial respiration is imperative.

Therapeutics.—*Externally and Locally.*—The drug is seldom used externally, although it has been employed by ophthalmologists as a mydriatic.

Internally.—Clinically, gelsemium is now considered less valuable than formerly. It has been favorably mentioned by certain authors in the treatment of *tetanus*, *mania* with motor excitement, and *paralysis agitans*.

The drug appears to be more serviceable in *trifacial neuralgia*,

and it seems to be even more efficient in neuralgia with involvement of the inferior dental nerve. In these disorders, as in *ovarian neuralgia*, *dysmenorrhea*, etc., for which it has been employed with some success, the drug should be pushed to its physiological limit.

Bartholow praised the action of gelsemium in *cerebro-spinal meningitis* and "*acute inflammations of the lungs and pleura*."

Bulkley is responsible for its use in *pruritus* and *eczema*, the itching of which it certainly appears to alleviate.

Contraindications.—Diseases accompanied by exhaustion and great muscular weakness.

Administration.—Any of the preparations may be given, the initial dose being small, and the amount increased gradually until dilatation of the pupil or drooping of the eyelids is manifest.

Physostigma—Physostigmatis—Physostigma.

U. S. P.

(CALABAR BEAN.)

Origin.—The seed of *Physostigma venenosum* Balfour, a lofty, half shrubby, climbing plant (somewhat resembling the scarlet runner or Spanish bean of our gardens), growing near the mouths of the Niger and Old Calabar Rivers in Western Africa, and attaining a height of 40 or 50 feet (12-15 M.).

Description and Properties.—The seeds are about 1 to 1½ inches (25-30 Mm.) long, ½ to ¾ inch (15-20 Mm.) broad, and ½ to 1 inch (10-15 Mm.) thick, oblong and somewhat reniform, testa granular, chocolate brown, with a broad, black groove extending the entire length of the convex edge, embryo with a short, curved radicle and two large, white concavo-convex cotyledons; inodorous; taste bean-like.

The drug contains an alkaloid, *physostigmine* (also known as *eserine*), which is the principal constituent; *calabarine*, to which the drug owes its retarding properties; and *eserine* (a laxative and motor excitant); besides a neutral principle, *physisterin*, related to cholesterol.

Dose.—1-4 grains (0.065-0.25 Gm.) [1½ grains (0.1 Gm.), U. S. P.].

Official Preparations.

Extractum Physostigmatis—**Extracti Physostigmatis**—**Extract of Physostigma**—**Dose**, ½ grain (0.03-0.01 Gm.) [½ grain (0.005 Gm.), U. S. P.]

Tinctura Physostigmatis—**Tincture Physostigmatis**—**Tincture of Physostigma**—**Dose**, 5-20 minims (0.3-0.6 Cc.) [15 minims (1 Cc.), U. S. P.].

The alkaloid, *physostigmine*, is not official. It occurs in colorless or slightly pinkish crystals, sparingly soluble in water, readily soluble in alcohol.

Dose—⅓-⅔ grain (0.0006-0.003 Gm.). The salicylate and sulphate of *physostigmine* are official.

Physostigminæ Salicylas—**Physostigminæ Salicylatis**—**Physostigmine Salicylate** (ESERINE SALICYLATE), U. S. P.

Description and Properties.—Colorless or faintly yellowish, shining, acicular, or short columnar crystals, colorless, and of a bitter taste, acquiring a reddish tint when exposed to light and air; soluble in 150 parts of water and 12 parts of alcohol. The sample should be kept in small, dark amber-colored, and well-stoppered vials.

Dose—⅓-⅔ grain (0.0005-0.002 Gm.) [⅔ grain (0.001 Gm.), U. S. P.]

Physostigminæ Sulphas—**Physostigminæ Sulphatis**—**Physostigmine Sulphate** (ESERINE SULPHATE), U. S. P.

Description and Properties.—A white, or yellowish-white, micro-crystalline powder, odorous, and of a bitter taste. It is very deliquescent when exposed to moist air, gradually forming a reddish in a red liquid. Very soluble in water and alcohol; still more so at the boiling-point of these liquids. It should be kept in small, dark amber-colored, and well-stoppered vials.

Dose—⅓-⅔ grain (0.0005-0.002 Gm.) [⅔ grain (0.001 Gm.), U. S. P.]

Antagonists and Incompatibles.—The action of physostigma upon the heart, respiration, and pupils is antagonized by atropine; that on the spinal cord, by chloral; while, in a general way, the motor excitants, particularly the tetanizing agents, are therapeutically antagonistic.

The caustic alkalies and tannic acid are chemically incompatible.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—No external action of physostigma and its preparations is noted, unless it be its effect upon the pupil, which outward application contracts, and the slight abolition of functional activity in the motor and sensory nerves, occasioned, it is said, by a strong solution of physostigmine.

Internally.—Digestive System.—The administration of the drug tends to stimulate the salivary, gastric, and intestinal secretions, and, by acting upon the muscular coats of the stomach and intestines, to increase peristalsis. Nausea, retching, vomiting, and purging may result. The intestinal contractions set up are very powerful, so much so that physostigmine has been used as a remedy for intestinal paresis following abdominal operations.

Circulatory System.—No influence on the blood has been detected. Small doses increase arterial tension, the heart's action becoming slower and stronger.

Nervous System.—The higher cerebral centers are not primarily affected by this drug in man. The medulla and cord are the main structures involved. After a transient stimulation depression sets in, the spinal reflexes being abolished, and final poisoning of the medullary centers occurs.

Respiratory System.—Small doses stimulate respiration. Larger amounts primarily depress the respiratory centers, stimulate the peripheries of the pulmonary vagi, and contract the caliber of the bronchial tubes, even to the extent of serious constriction, death usually resulting from asphyxia.

The breathing is first quickened and then retarded, the effect of the drug upon the respiration being more powerful than its circulatory influence, the heart continuing to beat for some time after pulmonary action has ceased.

Although the effect upon the heart is somewhat obscure, it appears that under poisonous doses the cardiac pulsations are greatly reduced, being slow and feeble, and finally ceasing altogether. It is reasonably supposed that this action is due to primary stimulation of the peripheral vagi, influencing the cardiac ganglia, and also to the effect upon the vasomotor centers. The subsequent exhaustion and relaxation of the arteries are doubtless the result of a similar influence.

There is marked elevation of blood-pressure under moderate doses, although there may occur a brief period of depression. Toxic doses are accompanied by a notable decrease of arterial tension, the cardiac ganglia being seized with paralysis, and the heart finally arrested in diastole.

Secretions.—All of the secretions, notably the tears, sweat, saliva, mucous secretions, pancreas, and bile, are markedly augmented.

Temperature.—A slight depression has been noted.

Eye.—Applied locally to the conjunctiva or introduced into the circulation, whether by ingestion or injection, physostigmine causes myosis or contraction of the pupil by stimulating the peripheral endings of the oculomotor nerves, possibly by a depression of the sympathetic fibers.

Other prominent symptoms present are spasm of accommodation and decreased intra-ocular tension and myopia. Irritation of the third nerve is the principal cause of these phenomena. The intra-ocular pressure is lowered (1) by lessening the blood-supply to the eye through contraction of the blood-vessels; (2) by diminishing the secretion of the aqueous humor from the glands on the surface of the ciliary body; (3) by contracting the iris, so that the aqueous humor can more readily pass through the canal of Schlemm.

Unstriated Muscle.—The full influence of the drug tends to produce uterine contractions, and it also influences the unstriated muscles of the bladder, ureter, bronchi, as well as the intestines, to increased contractions.

Absorption and Elimination.—The active principles of physostigma and its alkaloids are rapidly diffused in the blood. They are largely excreted by the kidneys, the bile and saliva contributing to the process of elimination, and have been detected in the gastric juices after intravenous injection.

Unward Action.—When eserine is applied to the eye it occasionally produces a nervous contractile pain in the entire eyeball, which extends in a manner similar to ciliary neurosis along the course of the supra-orbital nerve, resembling migraine.

Small doses have in some individuals produced nausea and general uneasiness, and occasionally intense pain in the epigastrium.

Poisoning.—Taken in poisonous doses, physostigma causes in from $\frac{1}{4}$ – $\frac{1}{2}$ hour, occasionally 2 hours, nausea, giddiness, and muscular tremors and weakness, followed by complete muscular relaxation. There are muscular tremors and intense salivation, increased tear-flow, and profuse perspiration. Involuntary urination and defecation have been observed. Cardiac action is diminished; the reflexes are in abeyance; the respiration is retarded, and myosis and motor paralysis are manifest. The pupils visibly contract, and purging and vomiting may ensue. Fatal results are possible through paralysis of the respiratory center and consequent asphyxia. The more rapid collapse succeeding the administration of lethal doses is due to cardiac syncope.

Doses of 4–9 grains (0.3–0.6 Gm.) of the seed have caused serious symptoms. Physostigmine salicylate $\frac{1}{4}$ grain (0.05 Gm.) has resulted in severe poisoning with recovery.

Treatment of Poisoning.—The stomach should be evacuated, the process being followed by the hypodermic injection of a solution

of atropine, which may prove an efficient physiological antidote. Tannic acid may be used as a chemical antagonist. Diffusible stimulants, such as ether or ammonia, may serve to arrest cardiac and respiratory failure. Digitalis and alcohol have also been successfully employed. Temperature should be maintained by the application of external heat.

Therapeutics.—*Externally and Locally.*—PHYSOSTIGMINE and ESERINE SULPHATE are the preparations usually employed, their only action of importance being in *diseases of the eye*. They are of value in breaking up adhesions of the iris to the cornea or lens, strengthening the muscle of accommodation, reducing intra-ocular pressure, and removing the effects of atropine, although Jessup claims that *complete* ciliary paralysis by atropine and the mydriasis induced by hyoscine are unaffected by eserine.

In certain cases of *ulcer of the cornea* uncomplicated with iritis and sloughing keratitis, where there is little inflammation or ciliary irritation, eserine sometimes produces prompt improvement when atropine has failed.

Paralytic mydriasis and *paralysis of accommodation* are temporarily relieved by this drug, and weak solutions have been employed with varying success in accommodative *asthenopia* without refractive errors.

The remedy is of unquestioned value in the early stages of *glaucoma*, but only at the commencement of an acute attack and contra-indicated in the hemorrhagic form. If the drug fails to contract the pupil when used for glaucoma, it may induce irritating spasm of the ciliary muscles by increasing the blood-supply to the iris.

PHYSOSTIGMINE is sometimes employed to prevent *prolapsus of the iris*, following peripheral perforation of the cornea or cataract extraction, particularly without iridectomy.

The remedy serves a useful purpose also in coal-miners' *nyctagmus*, 1 drop of a collyrium containing $\frac{1}{2}$ grain (0.006 Gm) of PHYSOSTIGMINE SULPHATE in 1 ounce (300 Cc) of distilled water being dropped into the eye three times a day. Eserine is also employed in *neuralgia of the eyeball* and *photophobia*.

Internally—PHYSOSTIGMA has proved efficacious in *constipation* due to an atonic condition of the intestines with deficient secretion. The state of the muscular intestinal layer frequently allows gas to accumulate in the bowels, with consequent troublesome *flatulence*. The drug, by imparting tone to the muscles and increasing peristalsis, greatly relieves this unpleasant condition. It is of inestimable value in the treatment of *intestinal paresis* following abdominal operations.

Gastric and intestinal dilatation have been successfully treated by Hare with this remedy. It is valuable in *chronic bronchitis* with dilatation of the bronchial tubes, and is said to relieve *bronchial asthma* and *emphysema*.

It has been recommended in tetanus and in general spasmodic disorders, but its efficacy is of questionable value.

Contraindications.—The same as for conium.

Administration.—The extract or the tincture is usually preferred for internal administration, although the alkaloid fully represents the drug and may be given either by the mouth or hypodermically. For application to the eye the salts of the alkaloid are used. A convenient form of physostigmine in ophthalmic practice is the medicated gelatin disks.

Grindēlia—Grindēliæ—Grindelia. U. S. P.

Origin.—The dried leaves and flowering tops of *Grindelia robusta* Nutt., and of *Grindelia squarrosa* Dunal, herbaceous or subfruticose perennials, indigenous in the western part of North America and Mexico.

Description and Properties.—Leaves about 2 inches (5 Cm.) long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate, often spinous-toothed or even lacinate-pinnatifid, pale green, smooth, finely dotted, thickish, brittle; heads many-flowered, subglobular or somewhat conical, the involucre hemispherical, about $\frac{1}{4}$ inch (10 Mm.) broad, composed of numerous imbricated, squarrose tipped, or spreading scales; ray florets yellow, ligulate, pistillate; disk florets yellow, tubular, perfect, pappus consisting of two or three awns of the length of the disk florets; odor balsamic, taste pungently aromatic and bitter.

The principal constituent is probably a resinous substance. It also contains an alkaloid principle, grindeine, and a volatile and a fixed oil.

Dose.—10 to 60 grains (0.6-4.0 Gm.) [30 grains (2 Gm.), U. S. P.].

Official Preparation.

Fluidextractum Grindēlia—**Fluidextracti Grindēliæ**—**Fluidextract of Grindelia.**—Dose, 10-60 minims (0.6-3.7 Cc.) [30 minims (2 Cc.), U. S. P.]

Antagonists and Incompatibles.—Aqueous preparations, the caustic alkalies, and mineral salts are incompatible.

Synergists.—The motor depressants.

Physiological Action.—*Externally and Locally.*—The drug is sedative and mildly astringent.

Internally.—**Digestive System.**—When ingested it excites a sense of warmth in the epigastrium, and in moderate doses increases the secretion of the gastric juice, stimulating the appetite and improving digestion.

Circulatory System.—The heart is slowed by medicinal doses through stimulation of the inhibitory center. The blood-pressure, however, is raised and maintained by stimulation of the vasomotor center.

Nervous System.—Grindelia possesses considerable power as a depressant. Its effect upon the motor mechanism is to cause a pronounced muscular weakness affecting first the lower extremities. The sensory nerves are first depressed, there being quite marked cutaneous anesthesia. The drug depresses the reflex mechanism in the spinal cord, so that the reflex movements are greatly lessened.

Respiratory System.—Small doses have little effect upon the respiratory movements; large doses retard the breathing, while toxic doses may produce death through paralysis of the respiratory muscles.

The drug slightly increases the secretion from the pulmonary mucous membrane and relaxes the circular fibers of the bronchial

muscles. The ends of the sensory nerves distributed to the pulmonary mucous membrane are also depressed.

Absorption and Elimination.—Grindelia is readily absorbed, and is eliminated chiefly by the kidneys, increasing the urinary flow, the lungs sharing in the excretory process.

Temperature is unaffected.

Eye.—Large doses cause dilatation of the pupil.

Uterus.—No effect has been noticed.

Outward Action.—Excepting drowsiness, reduction of cutaneous sensibility, slight gastric disturbance, and a feeling of weakness, no symptoms have been recorded.

Poisoning.—The drug is feebly toxic; excessive doses, however, act as a gastro-intestinal irritant. The patient is sleepy and complains of muscular weakness; there is a numb or anesthetic condition of the skin, while the pupils are dilated and the pulse and respiratory movements slow and feeble. Should death occur, it will be from paralysis of the muscles of respiration.

Treatment of Poisoning.—The same as in poisoning from conium—diffusible stimulants, strychnine, etc.

Therapeutics.—Externally and Locally.—Grindelia is a very efficient application to the skin in *rhus-poisoning*. Indeed, it serves as a soothing lotion in many acute inflammations of the skin, such as *eczema*, etc. The fluidextract used should be well diluted and applied on cloths.

Internally.—Grindelia has acquired an enviable reputation as a remedy for *spasmodic asthma*, its action upon the bronchial muscles rendering it singularly beneficial in this disorder. It acts to relax the spasm of the muscles. The drug has no influence, however, in preventing a recurrence of the paroxysms.

The drug has been highly recommended in *acute and chronic bronchitis*, *hay-fever*, *whooping-cough*, and in *spasmodic cough* of whatever nature. It has even been suggested as a palliative remedy in *pneumonia* and in cardiac and pulmonary *dyspnea*.

There are no special contraindications or directions for administration, save that the fluidextract is pharmaceutically incompatible with aqueous preparations.

Aspidospërma—Aspidospermâtis—Aspidosperma (unofficial).

Origin.—The bark of *Aspidosperma (huacacho-blano)* Schlechtendal, a large evergreen tree of exceedingly hard wood (Sp. *quedar*, to break, and *nacha*, an axe, analogous to the Argentine Republic).

Description and Properties.—Occurring in nearly flat pieces about $\frac{1}{4}$ to $\frac{1}{2}$ inches (12.0-30.0 Mm.) thick, the outer surface yellowish-gray or brownish, deeply fissured, inner surface yellowish-brown or reddish-brown, distinctly striate, fracture displaying two sharply defined strata of about equal thickness, both marked with numerous whitish dots and striae arranged in tangential lines; the fracture of the outer lighter-colored layer rather coarsely granular, and that of the darker-colored inner layer smooth, lustrous, moderate, taste very bitter and slightly anesthetic.

Six alkaloids have thus far been isolated from *Aspidosperma*, the most important being *aspidospermine* and *quercetamine*, the former occurring in colorless prismatic crystals, insoluble in water and soluble in 48 parts of alcohol.

Dose.—5-30 grains (0.3-2.0 Gm.).

Preparations.

Fluidextractum Aspidospermatis.—**Fluidextracti Aspidospermatis.**—**Fluid-extract of Aspidosperma.**—*Dose*, 5–30 minims (0.3–1.8 Cc.).
Aspidospermine.—*Dose*, $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.016–0.03 Gm.).
Quebrachine.—*Dose*, 1–2 grains (0.06–0.12 Gm.).

Physiological Action.—*Externally and Locally.*—No important action has been noted.

Internally.—**Digestive System.**—It is a stomachic, having an action analogous to the vegetable bitters.

Circulatory System.—Aspidosperma depresses the heart, rendering its action slower, with reduction of arterial tension.

Nervous System.—In its action it resembles conium. It depresses the motor mechanism by its influence on the motor centers, and lessens the reflexes through its influence on the spinal cord. Excessive doses cause vertigo and headache, together with paralysis of the extremities, the lower being first affected.

Respiratory System.—Medicinal amounts of aspidosperma retard the breathing, but deepen the inspirations; aspidospermine, on the contrary, increases the respiratory movements. Toxic doses paralyze the respiratory center, death resulting apparently from asphyxia and convulsions.

Absorption and Elimination.—It readily passes into the blood, and is excreted chiefly by the urine, the saliva and sweat sharing in the process of elimination.

Temperature.—It is antipyretic, febrile temperature being reduced by full doses of the drug.

Poisoning.—Aspidospermine is an active respiratory poison, the toxic symptoms being vertigo, headache, free diaphoresis and salivation, great muscular weakness, with paralysis of the lower extremities, slow and weak heart, reduction of temperature, marked depression of the respiration, and death from respiratory failure.

Treatment of Poisoning.—The same procedure is advisable as in cases of poisoning from the other motor depressants.

Therapeutics.—ASPIDOSPERMA is not employed locally, its chief value being in the treatment of *dyspnea* of whatever variety, though it is fair to state that Pluzoldt considers it contraindicated in cardiac *dyspnea*.

The drug is equal, if not superior, to *grindelia* in the treatment of *spasmodic disorders of the respiratory apparatus*.

By some clinicians it is claimed to be an efficient remedy in *pneumonia*, being especially useful in relieving cyanosis.

ASPIDOSPERMINE has been highly recommended as an antiperiodic in *malaria*, and has appeared to modify the symptoms of *acute articular rheumatism*.

Administration.—Both the fluidextract and the alkaloid may be given internally, although a favorite and efficient method of administering the alkaloids is by hypodermic injection.

Sūmbul—Sūmbul—Sumbul. U. S. P.

Origin.—The dried root of an undetermined plant, probably of the family *Cordeliaceae*. It is thought by some to be *Ferula sumbul* (Kauffmann) Hooker fil., a perennial about 8 feet (2.4 M.) high, indigenous in regions north and east of British India.

Description and Properties.—It occurs in transverse segments, varying in diameter from 1 to 3 inches (2-7 Cm.), and in length from 6 to 12 inches (14-30 Cm.). Light spongy, annulate or longitudinally wrinkled; bark thin, brown, more or less loosely fibrous, the interior whitish, with numerous brownish yellow resin dots and irregular, easily separated fibers; odor strong, musk-like, taste bitter and balsamic. It contains *inulin*, and *valerianic acid*, a small quantity of volatile oil, and two balsamic resins, to which its odor is due.

Dose.—15-30 grains (1.0-2.0 Gm.) [30 grains (2 Gm.), U. S. P.].

Official Preparations.

Fluidextractum Sūmbul—Fluidextracti Sūmbul—Fluidextract of Sumbul.

—**Dose,** average dose: 30 minims (2 Cc.).

Extractum Sūmbul—Extracti Sūmbul—Extract of Sumbul.—Prepared from the fluidextract of sumbul.

Dose.—Average dose: 4 grains (0.250 Gm. = 250 milligrammes).

Physiological Action.—See Antispasmodics (Valerian).

Therapeutics.—The drug is valuable in the various manifestations of *hysteria*, and has been employed with some success in *ovarian neuralgia* and *dysmenorrhea*.

It is similar to, though not so efficient as, *grindelia* in *spasmodic coughs*. Indeed, most of the disorders benefited by the antispasmodics yield to the influence of sumbul.

In *neurasthenia* with anemia the extract of sumbul, combined with iron and arsenic, serves a very useful purpose.

Vibŭrnum Prunifŏlium—Vibŭrni Prunifŏlii—Black Haw. U. S. P.

Origin.—The dried bark of *Viburnum prunifolium* L., a tall shrub or small tree, 10 to 20 feet (3-6 M.) high, growing in thickets throughout the greater portion of the United States east of the Mississippi.

Description and Properties.—Thin pieces or quills, glassy purplish-brown, with watered warts and minute black dots; when collected from old wood, grayish brown, the thin corky layer easily removed from the green layer; inner surface whitish, smooth, fracture short, inodorous, somewhat astringent and bitter.

It contains a bitter principle (*viburnin*), a bitter resin, *valerianic acid*, besides *tannic*, *oxalic*, *citric*, and *malic acids*.

Dose.—30-60 grains (2.0-4.0 Gm.) [30 grains (2 Gm.), U. S. P.].

Official Preparation.

Fluidextractum Vibŭrni Prunifŏlii—Fluidextracti Vibŭrni Prunifŏlii—Fluidextract of Black Haw.—**Dose,** $\frac{1}{2}$ -1 fluidram (1.8-3.7 Cc.).

Antagonists and Incompatibles.—It is chemically incompatible with iron and other substances affected by tannic acid.

Synergists.—Antispasmodics and uterine sedatives.

Physiological Action and Therapeutics.—The action of black haw is best understood by classing it with the volatile-oil group. It acts as an antispasmodic, diuretic, nervine, and tonic, being especially useful in various uterine disorders, such as *spasmodic* and *membranous dysmenorrhea*.

The various vasomotor disturbances and the *menorrhagia* inci-

dent to the menopause are frequently relieved by this remedy. It is also of some value in the *prevention of abortion*. Its sedative properties render it serviceable in relieving the severity of *after-pains*.

Viburnum Opulus—Viburni Opuli—Cramp Bark.

U. S. P.

Origin.—The dried bark of *Viburnum opulus* L., a small tree 10 to 15 feet (3-45 M.) high, and genous in Canada, the Northern United States, Europe, and Northern Asia.

Description and Properties.—Flatish or curved bands, or, occasionally, quills, sometimes 12 inches (30 Cm.) long and from $\frac{1}{8}$ to $\frac{1}{4}$ inch (1-15 Mm.) thick; outer surface ash gray, marked with somewhat transversely scattered, elongated warts of a brownish color, due to abrasion, and marked more or less with blackish dots, with black, irregular lines or thin ridges, arranged chiefly in a longitudinal direction; underneath the easily removed corky layer of a pale brownish or reddish-brown color; the inner surface dingy white or brownish, fracture tough, the tissue separating in layers—odorless; taste somewhat astringent and bitter.

Dose.—1-2 drams (4.0-8.0 Gm.) [30 grains (2 Gm.), *U. S. P.*].

Official Preparation.

Fluidextractum Viburni Opuli—Fluidextracti Viburni Opuli—Fluidextract of Cramp Bark.—*Dose*, 1-2 fluidrams (3.7-7.3 Cc.).

The general observations upon *Viburnum prunifolium* are applicable to this drug.

HYDROCYANIC ACID AND CYANIDES.

Acidum Hydrocyanicum Dilutum—Acidi Hydrocyanici Diluti—Diluted Hydrocyanic Acid. *U. S. P.*

Definition.—A liquid composed of not less than 2 per cent. by weight of absolute hydrocyanic acid, HCN, and about 98 per cent. of water.

Description.—A colorless liquid with characteristic odor, extremely poisonous.

Dose.— $\frac{1}{2}$ minims (0.1 Cc.), *U. S. P.*

Potassii Cyanidum—Potassii Cyanidi—Potassium Cyanide. *U. S. P.*

Origin.—Prepared by heating in an iron crucible a mixture of exsiccated potassium carbonate 5 parts and potassium carbonate 3 parts until effervescence ceases.

Description and Properties.—White, opaque, amorphous pieces, or a white, granular powder, colorless when perfectly dry, but in moist air exhaling the odor of hydrocyanic acid. The taste is sharp and somewhat alkaline, but should be tested with great care, as the salt is very poisonous. In moist air it deliquesces; soluble in about 2 parts of water and sparingly soluble in alcohol. Potassium cyanide should be kept in well stoppered bottles.

Dose.— $\frac{1}{2}$ grain (0.005-0.005 Gm.).

Antagonists and Incompatibles.—Atropine is a physiological antagonist; the diffusible stimulants also tend to counteract the effects of the drug. The metallic salts, particularly cobalt nitrate, are chemically incompatible.

Synergists.—The cardiac and motor depressants.

Physiological and Toxicological Action.—On the skin dilute hydrocyanic acid has little action—more concentrated solutions

cause numbness. On mucous membranes it causes a sensation of warmth; in the mouth salivation occurs, due to its acid burning and penetrating taste and odor. Numbness follows from the anesthetic action of the acid. On the mucous membrane of the stomach it has a similar action.

Circulatory System.—The heart is less affected than the medullary centers. The primary medullary irritation causes vagus stimulation and a slightly slowed heart—the blood-pressure rising at the same time; but on the advent of the medullary paralysis the pressure falls and the heart beats faster; but the oncoming of a true muscle-poisoning prevents it from beating very rapidly. Heart paralysis is secondary to medullary paralysis.

Nervous System.—In small doses it may cause a sense of giddiness, with temporary nausea and faintness. In toxic doses, however, it has a very pronounced action. The medullary centers are primarily involved, followed by other nervous centers. The respiratory center is primarily stimulated, rendering the respiratory movements fuller and more rapid. Convulsive respiratory movements and dyspnea supervene on larger doses—the rhythm being also influenced by the onset of generalized convulsive seizures which are characteristic of poisoning. Paralysis of respiration follows.

Consciousness is in the early stages clouded, headache and mental confusion are present, and complete unconsciousness soon develops if the dosage is large. Vasomotor and muscle paresis is later evident from the loss of blood-pressure and involuntary fecal and urinary evacuations.

Metabolism.—Hydrocyanic acid has a marked activity in intracellular metabolism. It seems to lock up, as it were, the vital processes—retarding them or completely destroying them, according to the grade of poisoning. It seems to prevent oxygen-absorption particularly. The venous blood retains its bright-red color because of the lack of reduction of the oxyhemoglobin.

Cyanide of potassium differs from hydrocyanic acid in no essential particulars.

BROMIDES.

Potassii Brômidum—Potassii Brômidi—Potassium Bromide (U. S. P.).—*Origin.*—Prepared by adding bromine to a solution of potassa, evaporating to dryness, mixing with charcoal, heating to redness, dissolving in water, and crystallizing. It should contain not less than 97 per cent. of pure potassium bromide.

Description and Properties.—Colorless or white cubical crystals or granules, odorless, with a pungent, saline taste; permanent in air, soluble in about 15 parts of water and in 180 parts of alcohol at 25° C.

Dose.—5-60 grains (0.3-4.0 Gm.) (15 grains (1 Gm.), U. S. P.)

Sodii Brômidum—Sodii Brômidi—Sodium Bromide (U. S. P.).—*Origin.*—Obtained from a solution of soda in the same manner as potassium bromide. It should contain when dried not less than 97 per cent. of pure sodium bromide.

Description and Properties.—Colorless or white cubical crystals, or a white granular powder, odorless, and with a saline, slightly bitter taste. From air the salt absorbs moisture without deliquescing. Soluble in 17 parts of water and in 125 parts of alcohol at 25° C. It should be kept in well-stoppered bottles.

Dose.—10-60 grains (0.6-4.0 Gm.) (15 grains (1 Gm.), U. S. P.)

Ammonii Brômidum—Ammonii Brômidi—Ammonium Bromide (U. S. P.).—*Origin.*—Obtained by neutralizing hydrobromic acid with ammonia or ammonium

carbonate, evaporating, and crystallizing. It should contain not less than 97 per cent. of pure ammonium bromide.

Description and Properties.—Colorless, transparent, prismatic crystals, or a white crystalline powder, odorous, and of a pungent, saline taste, permanent in the air. Soluble in 1.2 parts of water and in 12.5 parts of alcohol at 25° C.

Dose = 5–10 grains (0.3–2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Lithii Bromidum—**Lithii Bromidi**—**Lithium Bromide** (U. S. P.).—*Origin*.—Prepared by a solution of fuming bromine and lithium carbonate, the cool liquid being evaporated and crystallized. It should contain when well dried not less than 97 per cent. of pure lithium bromide.

Description and Properties.—A white granular salt, odorless, and having a sharp, slightly bitter taste; very deliquescent. Soluble in 0.6 part of water and very soluble in alcohol. It should be kept in well-stoppered bottles.

Dose = 5–20 grains (0.3–1.2 Gm.) [15 grains (1 Gm.), U. S. P.]

Calcii Bromidum—**Calcii Bromidi**—**Calcium Bromide** (U. S. P.).—*Origin*.—Prepared by combining pure calcium carbonate in hydrobromic acid and evaporating. It should contain not less than 97 per cent. of pure calcium bromide.

Description and Properties.—A white granular salt, odorless, of a sharp, saline taste, and very deliquescent. Soluble in 0.5 part of water and in 1 part of alcohol at 25° C. It should be kept in well-stoppered bottles.

Dose = 10–30 grains (0.6–2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Zinci Bromidum—**Zinci Bromidi**—**Zinc Bromide** (U. S. P.).—*Origin*.—Prepared by dissolving granular zinc in hydrobromic acid, concentrating the solution, acidulating with hydrobromic acid, and drying upon a water bath. It should contain when anhydrous not less than 97 per cent. of pure zinc bromide.

Description and Properties.—A white granular powder, odorless, and having a sharp, saline, and metallic taste. Very deliquescent. Readily soluble in water and alcohol.

Dose = 1–5 grains (0.06–0.3 Gm.) [2 grains (0.025 Gm.), U. S. P.]

Strontii Bromidum—**Strontii Bromidi**—**Strontium Bromide** (U. S. P.).—*Origin*.—Obtained by neutralizing hydrobromic acid with strontium carbonate filtration, and evaporation. It should contain not less than 97 per cent. of pure strontium bromide.

Description and Properties.—Colorless, transparent, hexagonal crystals, odorless, and having a bitter, saline taste. Very deliquescent. Soluble in 1 part of water and readily soluble in alcohol.

Dose = 5–30 grains (0.3–2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Acidum Hydrobromicum Dilutum—**Acidi Hydrobromici Diluti**—**Diluted Hydrobromic Acid** (U. S. P.).—*Definition*.—A liquid composed of not less than 10 per cent. by weight of absolute hydrobromic acid and 90 per cent. of water.

Description and Properties.—A clear, colorless liquid, odorless, and having a strongly acid taste. Mixable in all proportions with water and alcohol. It should be kept in glass-stoppered bottles, protected from light.

Dose = 20 minims to 2 fl. drachms (1.25–7.39 Cc.) [1 drachm (4 Cc.), U. S. P.]

Bromofórmum—**Bromofórmi**—**Bromoform** (U. S. P.).—*Definition*.—A liquid consisting of 99 per cent. by weight of absolute bromoform (CHI_3), and 1 per cent. of absolute alcohol.

Obtained by the action of bromine upon equal parts of methylic alcohol and caustic potash.

Description and Properties.—A heavy, transparent, colorless, mobile liquid having an ethereal odor and a penetrating, sweetish taste resembling chloroform. It is only slightly soluble in water, but readily in alcohol and ether. Specific gravity at 25° C., 1.508. It is only slightly volatile at ordinary temperature, boils at 148° C., and solidifies at 6° C.

Absolute bromoform is decomposed in presence of light and air more rapidly than chloroform. The addition of 4 per cent. of alcohol, as in the case of chloroform, will preserve bromoform for months. When decomposed, bromine is set free, which colors the liquid yellowish red.

Dose = 1–5 minims (0.06–0.3 Cc.).

Antagonists and Incompatibles.—The bromides are antagonized by the motor excitants and muscle stimulants. The incompatibles are acids, acidulous and metallic salts. Spirit of nitrous ether is incompatible with the ammonium bromide.

Synergists.—Their action upon the brain is enhanced by opium and the hypnotics, while the cardiac depressants increase the effect of potassium bromide upon the circulatory system.

Physiological Action.—The action of the bromides depends upon both ions found in the salt, since practically all are dissociable. Thus each bromide salt shows a certain amount of variation in its reaction. The action of the bromine ion is distinctive, however. The actions of the Na, K, NH_4 , Li, Zn, and Sr ions are also distinctive and obey the general laws of the inorganic salts. Potassium bromide being the most widely employed, its action will be considered in detail first.

Externally and Locally.—Potassium bromide is slightly sedative to mucous membranes when applied locally, lessening the reflex irritability, particularly of the pharynx.

Internally.—Digestive System.—Locally on the mouth and stomach it produces increased salivation and irritation, as a result of its salty taste. Excessive doses have occasioned a sense of coldness in the epigastrium, with nausea and looseness of the bowels.

Circulatory System.—Potassium bromide depresses the circulation, causing the pulse to become slower, softer, and weaker, and shortening the systole while prolonging the diastole of the heart. The caliber of the vessels is diminished, although arterial pressure is lowered. The potassium ion is responsible for the cardiac depression. It is not present in the other bromide salts.

Nervous System—Potassium bromide acts as a depressant to the cerebrum. It causes a retardation of the flow of ideas and somnolence. The functions of the motor areas are also depressed. This action on the cerebrum is believed to be due to the bromine ion. The sleep caused is of a dull and heavy character, not refreshing, and is not induced in the presence of pain, or great mental anxiety, or grief. On the medulla there is no marked action.

Spinal Cord.—Potassium bromide diminishes the reflex excitability of the spinal cord. This with its action on the motor centers causes marked depression in muscular activity. There is also a marked diminution, under large and continued dosage, in the activity of the sexual function, and the muscular power of the bladder is somewhat impaired. Anesthesia of the bladder, joints, skin, and mucous surfaces is a constant symptom of prolonged administration.

Respiratory System.—Under full doses the respirations are slower and shallower, owing to slight depression of the respiratory center, paralysis of which may cause death, although fatal paralysis may affect the heart because of the poisonous influence of the potassium ion upon the cardiac muscle.

Absorption and Elimination.—The bromides are very rapidly absorbed, and begin to be eliminated quickly, chiefly by the kidneys (increasing the flow of urine), and also by the skin, saliva, intestinal and mammary glands, and the bronchial mucous membrane. The sulphur nitrogen and chlorides in the urine are increased and the amount of phosphates decreased.

Notwithstanding the rapid elimination of the bromides, under prolonged administration they tend to accumulate in the system, being found abundantly in all parts of the body, particularly in the blood. Nerve-structures contain small amounts. The drug is often found in the urine several weeks after stopping its administration. It has been thought that the bromides were able to replace the chlorides in the tissues to a certain extent. This deduction has been made the basis of an important hypothesis for the treatment of epilepsy—to be considered later.

Temperature.—Immoderate doses cause a reduction of temperature, due to depression of the circulation and lessening of tissue-change.

Eye.—There may occur dilatation of the pupil, conjunctival catarrh, diplopia, amblyopia, dimness of vision, and dilatation of the retinal blood-vessels.

Uterus.—A diminution of the catamenia may sometimes be present.

Untoward Action.—The susceptibility of individuals to the untoward action of the bromides is extremely variable. The symptoms observed are—gastric uneasiness with eructation, nausea and vomiting, analgesia of the epiglottis and pharynx, bronchial catarrh, hoarseness and cough, acute coryza and conjunctivitis, offensive breath, dysuria, diminished sensibility of the genito-urinary mucous membrane, and a variety of cutaneous eruptions.

Poisoning.—*Bromism*, as the symptoms of poisoning are termed, may be divided into an acute and a chronic form.

Acute Bromism, resulting from a single toxic dose, is manifested by violent frontal headache, great muscular weakness, incoordination of movements, abolition of reflexes, somnolence, slow and shallow breathing, subnormal temperature, lusterless eyes, and very slow and weak pulse, death usually extremely rare, resulting from either respiratory or cardiac failure. Death has resulted from 2½ ounces (75 Gm.) taken in a period of forty-eight hours. Treatment of acute bromism is best effected by salt solution by hypodermoclysis, enteroclysis, or infusion.

Chronic Bromism, caused by prolonged use of the bromides, is characterized by mental apathy, constant drowsiness, hallucinations, depression, considerable cutaneous anesthesia, muscular weakness, poor circulation, cold extremities, marked anemia, impairment of the sexual function, deranged digestion, and cutaneous eruptions of various forms collectively designated as "bromine acne."

Its continued use over years may result in permanent mental impairment.

Treatment of Poisoning.—The drug should be immediately withdrawn and methods adopted to hasten elimination, such as the administration of diuretics, cathartics, etc. Tonics, such as strychnine, iron, and the cardiac stimulants, should be given, while exercise and change of scene may counteract the psychical symptoms.

It is claimed that the daily administration of Fowler's solution causes a rapid disappearance of bromine eruption.

Comparative Action of the Bromides.—POTASSIUM BROMIDE

contains 66 per cent. of bromine. It is the most toxic to the heart and muscular system.

SODIUM BROMIDE, 78 per cent. of bromine, is less hypnotic, as the sodium ion is known to increase cerebral activity, but the Na ion being indifferent to heart and muscle, it is less toxic.

AMMONIUM BROMIDE, containing the NH_4 ion, shows slight cardiac stimulation, but is otherwise identical with the potassium salt.

LITHIUM BROMIDE is the richest in bromine, containing 92 per cent., and is probably the most hypnotic of all. Its action more nearly resembles that of the sodium salt.

CALCIUM BROMIDE, while resembling them in its action, is less energetic than the other bromides.

ZINC BROMIDE is the most irritant, and is supposed to possess both tonic and sedative properties.

STRONTIUM BROMIDE is the mildest of all, being less prone to cause bromism. Its action is slow.

DILUTED HYDROBROMIC ACID in its action resembles the bromides, though much less depressant than the potassium salt, and less likely to occasion symptoms of chronic poisoning. As an acid it is a gastric irritant.

Therapeutics.—*Externally and Locally.*—Pharyngitis is relieved by a gargle containing potassium bromide and potassium chlorate. A solution of potassium bromide diminishes the sensibility of the throat, so that examinations are more easily made. A solution of 4 parts of potassium bromide in 20 parts of glycerin affords a soothing lotion in painful hemorrhoids.

Internally.—The BROMIDES are especially useful in allaying excessive brain activity, the *insomnia* (particularly the sleeplessness dependent upon nervous excitement, exhaustion, and irritability) and *headache of cerebral congestion*, yielding readily to these remedies.

They are considered to be very efficient medicinal agents for the relief of *epilepsy*, being given either alone or in combination with some vegetable bitter. Feré combines with them an intestinal antiseptic, asserting that the union lessens the tendency of bromism. Recent studies of Nencki on the power of potassium bromides to replace, in part, sodium chloride in the tissues suggested the idea of withdrawal of all salt from the epileptic's dietary and to replace it with small quantities of bromide. This permits of complete bromization with smaller quantities and is a distinctly useful procedure.

Being such marked depressants of the reflex centers, they are of decided benefit in nervous spasmodic disorders, and particularly valuable in *infantile convulsions*.

During dentition children suffer from various disturbances due to irritation of the dental nerve—*convulsions, cough, indigestion, diarrhea, strabismus*, etc.—in all of which the bromides, being powerful depressants of the reflex mechanism, prove of great value.

Whenever there is increased reflex excitability the bromides are indicated. They are therefore valuable in the *reflex disturbances of the menopause, spasmodic asthma, laryngismus stridulus, whooping*

cough, and other *coughs* of reflex origin. They have also been used in *tetanus* and *strychnine-poisoning*.

Excessive *nervous irritability* is quickly relieved by these remedies, either singly or in combination with some of the antispasmodics, such as *asafetida*, *valerian*, etc.

Because they depress the sexual mechanism they are of decided benefit in *spermatorrhea* of the plethoric or in the condition arising from irritation of the deep urethra. *Menorrhagia* resulting from excessive ovarian excitement is frequently relieved by these agents, while *nymphomania* and *delirium tremens* are often greatly benefited by full doses of the bromides.

The AMMONIUM BROMIDE has been employed with benefit, it is said, in *diabetes* of nervous origin. *Cerebral vomiting* and the *vomiting of pregnancy* are sometimes singularly amenable to the influence of the bromides.

A combination of SODIUM BROMIDE, spirit of nitrous ether, and tincture of aconite, in anise water, as a remedy in *acute febrile attacks* of children with delirium is of distinct value. Small doses are given at frequent intervals until there is a decided improvement in the symptoms.

The sedative action upon the circulatory apparatus exerted by potassium bromides renders it valuable in *cardiac irritability* when not due to anemia. It is particularly useful in quieting the heart's action in *exophthalmic goiter*.

The bromides are distinctly valuable in combination with chloral to relieve *chordae* and to diminish the tendency to sexual excitement which is antecedent to this condition. In irritative cystitis the bromides are also of service.

Bromides are useful in the convulsive respiratory disorders, and are also helpful in *seasickness*.

DILUTED HYDROBROMIC ACID is used for the same purposes as the bromides, some clinicians preferring it to the latter to quiet the *delirium of simple continued fevers*. It is employed extensively to relieve the symptoms of *cinchonism*.

Bromoform is useful as an antispasmodic in *whooping cough*, but it should be carefully administered, as dangerous collapse, as in chloroform poisoning, has been frequently reported.

Contraindications.—The bromides are contraindicated in conditions of great debility, anemia, or fatty or weak heart with low arterial pressure.

Administration.—The bromides should be given in solution, and when long continued, as in the treatment of epilepsy, they should be accompanied by restorative agents. Carbonated waters, milk, and aromatic elixir serve as efficient vehicles to disguise the taste of these salts.

Children acquire a remarkable tolerance for the bromides, so that large doses may be given them with little danger.

Bromoform may be dropped into a spoonful of water and administered in this simple manner, or it may be dissolved in glycerin.

The diluted hydrobromic acid should be given in water or syrup.

MOTOR EXCITANTS.

From a general point of view there are a large number of drugs that might readily be classed as motor excitants. Thus belladonna causes increased motor excitability, and might be here included. This illustrates the futility in the present state of pharmacological knowledge of employing such widely descriptive terms. The drugs belonging to this group excite the functional activity of the spinal cord and the sympathetic nervous system. They serve to stimulate muscular contraction and the functional operations of the heart, lungs, and secretory apparatus.

It is difficult to separate by sharply defined limits the remedies having these actions and group them according to their analogous therapeutic uses. In the present group, for instance, are placed ergot and gossypium, chiefly used for their action upon the uterus, while those drugs which, although excitomotors, are employed principally for their action upon the circulatory system are placed in the group of *cardiac stimulants*.

The strychnine group of motor excitants contains a number of drugs that act largely on the spinal cord, increasing the activity of its reflex functions. The more important of these are *nuxvomica*, containing strychnine and brucine; *thebaine* in opium; *gelsemium*, the gelsenine of which acts as strychnine; the gelsenimine, as has already been seen, behaving like coniine; *spigelia* also contains a tetanizing alkaloid; *physostigma* contains calabarine of similar action.

Bacillus tetani contributes a tetano-toxin, with a typical strychnine-like action.

Nux vomica itself has been widely used in medicine. Our modern knowledge dates back to 1540, when it was exported from the East Indies. Many of the natives of Java and of South America have used various species of *strychnos* in the preparation of arrow poisons.

The most typical member of the group is *nux vomica*.

Nŭx Vōmica—Nŭcis Vōmicæ—Nux Vomica.

U. S. P.

Origin.—The dried, ripe seed of *Strychnos Nux-vomica* L. Yielding when assayed not less than 1.25 per cent. of strychnine.

Nux vomica is a small tree common in many parts of Hindustan, Farther India, some of the East Indies, and in some parts of Australia.

Description and Properties.—*Nux vomica* is about 1 inch (.25 Mm.) in diameter, orbiculate, grayish or greenish-gray; soft-hairs, of a silky luster, with a slight ridge extending from the center of one side to the edge; internally horny, somewhat translucent, very tough, with a large circular cavity, into which the heart-shaped, nerved cotyledons project. It is insensuous and persistently bitter.

Nux vomica contains two important alkaloids—*strychnine* and *brucine*, the former being in excess. The seeds also contain igasine acid, with which these alkaloids are combined. Of total alkaloids the drug should contain from 2.5 to 5 per cent. Strychnine is a quinoline derivative, brucine being closely related. The former is found in from $\frac{1}{2}$ to 2 per cent. in the seed, the latter in smaller proportions, but in *Strychnos ignatia* brucine is found in comparatively large quantities. Strychnine was isolated by Pedler in 1818, brucine in the following year, and notwithstanding constant research the exact composition is not definitely known. Suffice it for the present to class them with the chinoline alkaloids.

Dose.—1-5 grains (.006-0.3 Gm.) [1 grain (.065 Gm.), U. S. P.]

Official Preparations.

Extractum Nucis Vomicae—Extracti Nucis Vomicae—Extract of Nux Vomica.—*Dose*, $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.008–0.003 Gm.) [$\frac{1}{4}$ grain (0.015 Gm.), U. S. P.]

Flüidexträctum Nucis Vomicae—Flüidexträcti Nucis Vomicae—Fluidextract of Nux Vomica.—*Dose*, 4–5 minims (0.06–0.3 Cc.) [$\frac{1}{2}$ min. (0.05 Gm.), U. S. P.]

Tinctura Nucis Vomicae—Tincturæ Nucis Vomicae—Tincture of Nux Vomica 10.1 Gm. strychnine in 100 Cc.)—*Dose*, 5–20 minims (0.3–1.2 Cc.) [10 minims (0.6 Cc.), U. S. P.].

Strychnina—Strychninæ—Strychnine. U. S. P.

Origin.—An alkaloid obtained from *nux vomica*, and also derived from other plants of the *Loranthaceæ*.

Description and Properties.—Colorless, transparent, octahedral or prismatic crystals, or a white, crystalline powder, odorless, and having an intensely bitter taste, perceptible even in highly dilute (1 : 700,000) solution. Permanent in the air. Soluble at 15° C. (59° F.) in 6400 parts of water, in 110 parts of alcohol, in 2500 parts of boiling water, and in 12 parts of boiling alcohol; also soluble in 7 parts of chloroform, but almost insoluble in ether.

Dose.— $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.001–0.004 Gm.) [$\frac{1}{4}$ grain (0.001 Gm.), U. S. P.].

Official Preparations.

Strychninæ Nitras—Strychninæ Nitratis—Strychnine Nitrate (U. S. P.)—Colorless, glittering needles, odorless, and having an intensely bitter taste; permanent in the air. Soluble in water (1 : 42), alcohol (1 : 120), and glycerin (1 : 60); much more soluble in warm water or alcohol. The nitrate contains no water of crystallization and is permanent in the air.—*Dose*, "Average dose: $\frac{1}{4}$ grain (0.001 Gm. = 1 milligramme)," U. S. P.

Strychninæ Sulphas—Strychninæ Sulphatis—Strychnine Sulphate (U. S. P.).—**Description and Properties.**—Colorless or white, prismatic crystals, odorless, and having an intensely bitter taste, perceptible even in highly dilute (1 : 700,000) solution. Efflorescent in dry air. Soluble at 25° C. in 31 parts of water and in 15 parts of alcohol, also soluble in 2 parts of boiling water and 8.5 parts of boiling alcohol. Almost insoluble in ether.—*Dose*, $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.001–0.004 Gm.) [$\frac{1}{4}$ grain (0.001 Gm.), U. S. P.].

Strychnine or its salts enter into a number of official preparations.

Antagonists and Incompatibles.—Chloral, chloroform, ether, and other of the methane derivatives antagonize the toxic action of strychnine.

The incompatibles are tannic acid, bromides, iodides, and chlorides.

Synergists.—The motor excitants, ergot, ustilago, electricity, and cold.

Physiological Action.—Since strychnine fully represents the physiological action of *nux vomica*, that of the former is here given.

Externally and Locally.—In large doses strychnine acts as an antiseptic, but on account of its poisonous nature it is too dangerous to be serviceable. When applied locally to unicellular organisms, in very dilute solutions, the drug acts as a stimulant, increasing their movements. In slightly more concentrated solutions strychnine arrests these movements and destroys life.

Internally—Digestive System.—Strychnine is an excellent stomachic tonic, improving the appetite greatly and aiding digestion. By its action as a bitter it reflexly stimulates the saliva and increases the secretion of gastric juice, and by imparting tone to the muscular walls of the intestines it increases peristalsis and allays constipation.

when due to lack of muscular tone. Strychnine is fully absorbed and exerts its chief activities in the spinal axis.

Circulatory System.—Strychnine stimulates the heart by its action on the cardiac muscle. Pharmacologically the pulse should be decreased, owing to the stimulating action of the vagus center in the medulla. But this depressing influence seems to be overcome by the direct stimulating action upon the heart-muscle. In therapeutic doses it is generally held that the pulse is slightly increased. In poisonous doses the pulse is slowed and weakened, owing to overstimulation of both the heart-muscle and the motor mechanism. There is marked increase in the blood-pressure, with constriction of the vessels, particularly those of the viscera.

Nervous System.—Strychnine increases markedly the excitability of the central nervous axis. On the cerebrum it acts as an excitant, particularly keying up the patient. The motor cortex is somewhat stimulated. The acuity of the special senses is heightened. It stimulates attention. Even its cerebral action may be interpreted, however, as due to an increase in the reflex excitability. Physiologically it may be said that the motor and sensory neurons are more closely bound together, either being more permeable to nervous influences or their insulation becomes reduced. There is no direct impairment of consciousness as the result of large doses.

Spinal Cord and Peripheral Nerves.—The first symptom of the drug is an increase in the spinal reflexes. Thus Holton and Muirhead think is due to a diminished resistance between the cells in the anterior and posterior horns of the cord. Normally, stimulation of a certain part—as, for instance, of a frog's toe—simply occasions a movement of the part stimulated, no other point being affected. But under the influence of strychnine the slightest stimulation is often sufficient to throw the whole body into tetanic contraction, showing that not only is the resistance in the normal path followed by lessened reflexes, but that resistance in all directions is diminished to such an extent that the impulse affects the entire muscular system. This action on the reflexes is principally on the cord. In fact, the action of strychnine upon the cord seems to be more powerful than upon any other portion of the central nervous axis. Very large doses of strychnine cause paralysis of the motor apparatus, with loss of voluntary movement, due to overstimulation of the reflex centers in the cord, producing exhaustion.

It must be remembered that strychnine does not increase the automatic powers, but simply augments their susceptibility to external stimulation; the slightest external stimulus leading to a greatly exaggerated reflex; the exact mechanism in man is not yet known. Analogies drawn from the reflexes in frogs are not reliable. The reflexes in the human spinal cord are so complex that a study of the action of strychnine on monkeys alone will probably unravel the actual feature in its activity.

Respiratory System.—By the stimulating effect of strychnine upon the respiratory center in the medulla the breathing is rendered

quicker and deeper. Owing to the tetanic contractions of the respiratory muscles, under poisonous doses the breathing is greatly interrupted, and the patient may become asphyxiated. At length, the respiratory muscles becoming completely exhausted, death ensues either from excessive tetanic contraction and asphyxiation or from central respiratory paralysis. It is to be noted that the heart continues to beat for some time after respiration has ceased.

Absorption and Elimination—Strychnine is rapidly absorbed and slowly excreted. It is eliminated mainly by the kidneys, appearing in the urine as strychnine, and is also slightly excreted by the skin and the salivary glands. It has been detected in the urine as late as eight days after ingestion.

Metabolism—From its marked action in increasing muscular activity metabolism is greatly hastened. Carbon dioxide is increased and there is heightened oxidation.

Temperature.—Under therapeutic doses the temperature is slightly raised, owing to increased oxidation, as shown by the increase of urea and carbon dioxide eliminated, and of oxygen taken in. During the tetanic convulsions the body temperature is markedly raised, though it is generally greatly reduced during the stage of exhaustion immediately preceding death.

Etc.—The general nervous stimulation produced by strychnine affects the mechanism of the eye; vision, as has been remarked, being rendered more acute.

Unusual Action.—Certain peculiar manifestations, having but slight resemblance, or none whatever, to the characteristic symptoms of poisoning, have followed the ingestion of small doses of strychnine, such as scarlatiniform eruption; cramps followed by perspiration, resembling in some respects the tertian type of intermittent fever; redness of the eyes; formication, a peculiar heaviness and stiffness of the limbs; persistent and painful priapism; and gastric uneasiness.

Poisoning—As is the case with other active poisons, strychnine in lethal doses produces varying effects, dependent upon temperament, idiosyncrasy, and physiological conditions. Generally speaking, the absorption of large doses is followed by rigidity of the lower maxillary, dilatation of the pupils, increased action of the reflexes, and spasmodic and distressing muscular contraction, affecting the extensors particularly. Finally, the respiratory muscles are affected with tetanic rigidity, death resulting from asphyxia. In many cases the earliest symptoms of poisoning are restlessness and anxiety, twitching of the muscles, and stiffness of the neck. Spinal convulsions are manifested, the patient assuming the position of opisthotonos, so that he rests upon his head and his heels.

The slightest external irritation at this stage, even a movement of the bedclothes, is sufficient to cause a recurrence of convulsions. Notwithstanding these grave symptoms, the mind remains unaffected until carbonic-acid poisoning sets in, and the stomach is usually retentive. Accompanying the usual symptoms in cases of acute poisoning is the distortion of the features, which assume

a ghastly grin (*risus sardonicus*). The action upon the genito-urinary tract is quite marked, involuntary ejaculations of semen frequently taking place, together with incontinence of urine.

The earlier paroxysms attendant upon the effects of the drug are seldom fatal, but in the intervals of repose the patient's mind is oppressed with a sense of impending dissolution, intensified by each renewed access of spasm and increasing severity of pain.

Symptoms from $\frac{1}{4}$ grain usually begin $\frac{1}{2}$ hour after taking. Patients have been known to die from fatal dose in 15 minutes. Two hours is more often—6 to 8 hours also. Minimum lethal dose lies between $\frac{1}{4}$ to $\frac{1}{2}$ grain (.030-.010 Gm.). Birds are usually immune to strychnine.

Treatment of Poisoning.—Emetics and cleansing of the stomach are naturally of the first importance. Animal charcoal and tannic acid should be freely administered, while copious anal injections containing potassium bromide and chloral are often efficacious in relieving the spasms. Chloroform may be needed. Artificial respiration is imperative, but must be continued for a long time, as the drug is so slowly eliminated.

Therapeutics.—The chief local action of strychnine is that of a bitter. There is no more efficient remedy in *atonic dyspepsia* than *nux vomica* or strychnine. Both possess all the properties of the simple bitters, besides stimulating the nerve-centers, rendering the coördination of the digestive process more perfect and enabling the stomach to respond more readily when the stimulus of food is applied to it. Small doses, 5 to 10 minims of the tincture, frequently repeated—intermitting.

The *gastric catarrh* of inebriates is especially benefited by this drug, which also serves a useful purpose in the *vomiting of pregnancy* and of *phthisis*.

Its tonic action upon the intestinal muscles renders it an invaluable remedy in *habitual constipation*, *atonic diarrhea*, and *prolapsus of the rectum*.

Strychnine is a most valuable cardiac tonic, having a marked action on the cardiac nervous system and also upon the heart-muscle. In *pneumonia*, *typhoid fever*, and other diseases accompanied by dyspnea and feeble heart-action, it is very beneficial. It is particularly valuable in failing blood-pressure. The hypodermic injection of full doses of strychnine ordinarily renders the pulse full and strong, even when it is scarcely perceptible, and death appears imminent. Many clinicians believe that they have tided pneumonic patients over the critical period by the heroic use of strychnine. The *functional irregularity of the heart's action* accompanying *hysteria*, *hypochondriasis*, and *pregnancy* is greatly relieved by moderate doses of tincture of *nux vomica*.

As a tonic in *chlorosis* and *anemia* strychnine is an esteemed remedy, particularly in combination with iron and arsenic.

In *bronchial* and *neurotic asthma*, as well as in many forms of *neuralgia*, particularly the visceral variety, the drug is an efficient

remedy. In *bronchitis* also, and to relieve the *coughs*, of neurotic origin, it is of great value.

Strychnine is particularly valuable in all of the affections of the spinal-peripheral motor neuron. Anterior poliomyelitis, and the various neuritides. Lead, alcohol, tobacco, diphtheria, typhoid, grippe, pressure *neuritides* are much benefited by large doses.

Strychnine is exceedingly efficacious in *amaurosis* due to excessive use of alcohol or tobacco, being also valuable in *paresis of the ocular muscles*. *Night-blindness* is also greatly benefited by this drug.

The weak and semiparalytic condition sometimes induced by bromides is improved by strychnine.

Hammond has obtained excellent functional results in *tubes* from massive doses of strychnine.

It is of undoubted merit in *delirium tremens*, as well as in preventing the usual effects of alcoholic intoxication; in fact, the drug is one of the best remedies in the treatment of *alcoholism*, the strychnine nitrate being usually employed—hypodermically. According to the best authorities on dipsomania, strychnine seems to be a true antagonist to the untoward action of alcohol, and it is probably the important constituent of the numerous "cures" for the alcohol habit.

No less valuable is strychnine in the treatment of acute *poisoning* by *chloral*, *morphine*, and *ph; sostigmine*.

As an aphrodisiac it is of unquestioned value in *functional spermatorrhoea*, and it is thought to produce contractions of the gravid uterus and cause *abortion* or *premature delivery*. When a predisposition to *post-partum hemorrhage* exists, the administration of strychnine may prove of great service.

Finally, strychnine has been highly recommended in the *night-sweats of phthisis* and in *diabetes mellitus*.

Contraindications.—Strychnine is contraindicated in acute inflammatory conditions of the spinal cord and excessive reflex irritability.

Administration.—The extract of *nux vomica*, the tincture, the fluidextract, or the alkaloid strychnine may be given and gradually increased. Better results are usually obtained if the drug is withheld for a time after its gradual use. The salts of strychnine are preferable to other preparations, the crude drug and its preparations varying greatly in strength, 10 minims (0.6 Cc) of one tincture sometimes containing as large a percentage of strychnine as 20 minims (1.2 Cc.) of another.

The drug should be cautiously administered to children, the initial dose for a child five or six years of age not exceeding $\frac{1}{16}$ grain (0.0006 Gm.).

In using strychnine hypodermically the soluble hypodermic tablets should be freshly dissolved in distilled water.

The solution of strychnine and of the other alkaloids should not be kept in stock, as they become contaminated with microscopic plants.

Hydrästis—Hydrästis—Hydrastis. U. S. P.

(GOLDEN SEAL.)

Origin. The dried rhizome and roots of *Hydrastis canadensis* L., yielding, when assayed, not less than 2.5 per cent. of hydrastine. Closely related to strychnine in some particulars, and also having a marked action on unstriated muscle, raising blood-pressure, exerting an influence on the uterine muscle and on the walls of the stomach and bladder in the alkaloid hydrastine of hydrastis. Hydrastis is a perennial native to Canada and the United States east of the Mississippi, growing in rich woodlands and in the Southern States, confined to mountainous districts.

Description and Properties. The rhizome is from 1 to 2 inches (2-5 Cm.) long and about $\frac{1}{2}$ inch (6 Mm.) thick, oblique, with short branches, somewhat annulate and longitudinally wrinkled; externally brownish-gray; fracture short, waxy, reddish yellow, with a thickish bark, about ten narrow wood wedges, broad medullary rays, and large pith. Roots thin, brittle, with a thick yellow bark and subquadrangular woody center. Odor slight, taste bitter.

The principal constituents are *hydrastine* (colorless and slightly acid), *berberine* (yellow and intensely bitter) and *xanthopurine* or *canadine*. Berberine is also found in berberis, columba, menispermum, cypripis, etc. Hydrastine, an artificial alkaloid prepared from hydrastine, has a very marked action on blood pressure.

Hydrastine is related chemically to narcotine, of the opium series.

Dose.—30 grains (2 Gm.), U. S. P.

Official Preparations.

Fluidextractum Hydrästis—Fluidextracti Hydrästis—Fluidextract of Hydrastis.—*Dose*, 10-30 minims (0.6-2.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Glyceritum Hydrästis—Glyceriti Hydrästis—Glycerite of Hydrastis.—Used externally.—*Dose*, 30 minims (2.0 Cc.), U. S. P.

Tinctura Hydrästis—Tinctura Hydrästis—Tincture of Hydrastis (20 per cent.).—*Dose*, 30-60 minims (2.0-4.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Hydrastina Hydrastinae—Hydrastine. An alkaloid obtained from hydrastis. *Origin, Description, and Properties.*—Colorless, very brilliant, glassy crystals; taste slightly acid; fairly soluble in ether and chloroform, but freely soluble in water.—*Dose*, $\frac{1}{4}$ grain (0.002-0.03 Gm.) [$\frac{1}{4}$ grain (0.01 Gm.), U. S. P.]

Hydrastinae Hydrochloridum—Hydrastinae Hydrochloridi—Hydrastine Hydrochloride (U. S. P.).—*Origin.*—The hydrochloride of an artificial alkaloid derived from hydrastine.

Description and Properties.—Light-yellow, amorphous granules, or a pale yellow crystalline powder, odorless, and having a bitter, saline taste, deliquescent on exposure to damp air. Soluble in 0.3 part of water and in 1 part of alcohol. The product should be kept in well stoppered vials.—*Dose*, $\frac{1}{4}$ -1 grain (0.005-0.03 Gm.) [$\frac{1}{4}$ grain (0.03 Gm.), U. S. P.]

Antagonists and Incompatibles.—The alkalies, mineral acids, and tannic and other vegetable acids are incompatible with preparation of hydrastis. The physiological antagonists are the methane hypnotics.

Synergists.—Quinine and the vegetable bitters aid its action upon the digestive tract, ergot upon the uterus, and strychnine upon the spinal cord.

Physiological Action.—*Externally and Locally.*—Hydrastine possesses astringent and antiseptic properties when applied locally.

Internally.—**Digestive System.**—Its action is that of a bitter, stimulating the saliva and enteric secretions. In excessive doses it produces gastric disturbance, almost invariably occasioning vomiting.

Circulatory System.—The vagus is stimulated, causing a preliminary slowing of the heart. It may also have a distinct poisonous

action on the heart-muscle. Arterial tension is raised. Large doses weaken the heart and drop pressure. In its effect upon the white blood-corpuscles it resembles quinine.

Nervous System.—The action of hydrastis on the nervous system is similar in many respects to that of strychnine, particularly on the medulla and spinal cord. Cerebral effects are not described with definiteness in man.

Spinal Cord and Peripheral Nerves.—The cord is stimulated. The reflexes are increased with tonic, and at times clonic, convulsions, and tetany of the respiratory musculature may occur.

Respiratory System.—It stimulates the respiratory center.

Absorption and Elimination.—It is slowly absorbed, tending to accumulate in the system. It is eliminated chiefly by the kidneys, increasing slightly the urinary flow.

Temperature.—Medicinal doses have no effect; poisonous doses decrease bodily heat.

Eye.—It has no particular action upon the eye, other than at first to contract and then to dilate the pupil when directly applied.

Uterus.—Hydrastine is a feeble oxytocic, affecting the womb in a manner similar to, though much less powerful than, ergot.

Pembrey and Phillips claim that it has no action on the uterus.

Poisoning.—The symptoms are almost identical with those of strychnine, and the same line of treatment is to be followed. Fatal poisoning is practically unknown.

Therapeutics.—Externally and Locally.—The fluidextract of hydrastis, 15 to 20 minims (1.0–1.2 Cc.) to 4 ounces (118 Cc.) of water, makes an efficient injection in gonorrhea.

The topical action of hydrastis and its preparations is that of an antiseptic and tonic, strengthening the circulation and nutrition, rendering the drug peculiarly valuable in diseases of mucous surfaces.

The TINCTURE—1 fluidram (3.7 Cc.) to 1 ounce (30.0 Cc.) of water—is a valuable mouth-wash in all indolent and offensive ulcerations of the mouth and throat, such as syphilitic and mercurial affections, follicular pharyngitis, etc.

The FLUIDEXTRACT serves a useful purpose in the local treatment of anal fissures and of rectal ulcer, vaginal and uterine ulcerations and leukorrhea. Indolent ulcers are stimulated by the bitter action to a healthier condition by the application of this preparation.

Internally.—As a remedy for diseased conditions of the stomach and bowels it is of much the same value as the vegetable bitters and may be used for the same purpose.

HYDRASTINE, and more particularly hydrastinine or its closely related body columbine, acts upon the uterus very much like ergot, and has been highly recommended by well-known authorities in uterine hemorrhages and other uterine disorders for which ergot is used. By careful observers, of experience with the drug, it is considered superior to ergot in the hemorrhage of puberty and the menopause as well as congestive dysmenorrhea.

Koniger has treated hemophysis successfully with the FLUID-

EXTRACT in 20- or 30-minim (1.2-2.0 Cc.) doses, repeated several times a day. The drug has proved equally beneficial in arresting the *night-sweats of phthisis*, and is an efficient substitute for alcoholic stimulants when their use is abandoned.

Administration.—When taken for its action upon the stomach and bowels it should be given before meals; for its effect on the uterus it is best administered in divided doses or the hydrastine hydrochlorate hypodermically.

Cotarnine is a synthetic product from narcotin, and used as a styptic and in uterine hemorrhage in $\frac{1}{4}$ -grain doses thrice daily or oftener.

COCA.

Erythroxylon Coca.—Students frequently confuse this drug with the cacao that gives the widely used drink cacao and chocolate, the *Theobroma cacao*. Needless to say they are widely separated products. The active principle of Erythroxylon is COCAINE, also a tropane derivative. It is also supposed to be a methyl piperidine. Its structural formula reveals a close relationship to that of atropine.

Cōca—Cōcæ—Coca. U. S. P.

Origin.—The dried leaves of *Erythroxylon Coca* Lam., known commercially as Huancoco Coca or of E. Truxillense, Rushy, known commercially as Truxillo Coca, yielding when assayed not less than 0.5 per cent. of the ether-soluble alkaloids of coca.

Coca is indigenous in the mountains of Peru and Bolivia, and on the eastern slopes of the Andes, is cultivated in damp, warm valleys from 3000 to 6000 feet (914.5-1829 M.) above the sea level, being also grown in some parts of Colombia, Brazil, the Argentine Republic, and the island of Java. The province of La Paz in Bolivia produces the largest crops, the article being more highly esteemed than the Peruvian variety. Cocaine is obtained from leaves of several varieties of *Erythroxylon*.

The active constituent is the alkaloid cocaine, 0.36 to 1.07 per cent. The plant also contains a number of allied alkaloids, *cinnamyl cocaine*, *cocamine*, *isococamine*, *trapaucamine*, *hygrine*, etc. These are all found in minute quantities.

Dose.— $\frac{1}{2}$ -1 drachm (2.0-16.0 Gm.) [30 grains (2 Gm.) U. S. P.]

Official Preparations.

Flüidextrāctum Cōcæ—Flüidextrācti Cōcæ—Fluidextract of Coca.—**Dose.** 20 minim-1 fluidrachm (1.2-4.0 Cc.) [30 minima (2 Cc.) U. S. P.]

Vinum Cōcæ—Vini Cōcæ—Wine of Coca (U. S. P.)—An official wine prepared from the fluidextract of coca.

Dose.—Average dose: 4 fluidrachms (16 Cc.) U. S. P.

Cocaina—Cocainæ—Cocaine.

Definition.—An alkaloid $[C_8H_{13}(C_8H_7CO)NO.CO_2CH_3]$ obtained from several varieties of coca.

Description and Properties.—Slightly soluble in water (1:600), much more so in alcohol (1:5), more readily in both when warm; insoluble in glycerin.

Cocaine is a methyl compound of benzoylecgonine. When it is boiled with water methyl alcohol is first split off, then benzoic acid, these changes occur more rapidly with dilute acids or barium hydroxide. Conversely cocaine may be built up by introducing the methyl and benzoic groups into ecgonine (a compound having the empirical formula, $C_8H_{13}NO_3$).

Dose.—“Average dose: 0.030 Gm. = 30 milligrammes ($\frac{1}{4}$ grain)” U. S. P.

Official Preparation.

Oleūm Cocainæ—Oleūti Cocainæ—Oleate of Cocaine.—Containing 5 per cent. of cocaine.

**Cocainæ Hydrochlōridum—Cocainæ Hydrochlōridi
—Cocaine Hydrochloride. U. S. P.**

Definition.—The neutral hydrochloride of the alkaloid cocaine.

Description and Properties.—Colorless, transparent crystals or a white, crystalline powder, odorless, of a saline, slightly bitter taste, and producing upon the tongue a tingling sensation followed by numbness of some minutes' duration. Permanent in air, soluble in 0.4 part of water and 2.0 parts of alcohol at 25° C.; very soluble in boiling water and in boiling alcohol.

Dose.— $\frac{1}{2}$ –2 grains (0.008–0.12 Gm.) [$\frac{1}{4}$ grain (0.03 Gm.), U. S. P.].

Antagonists and Incompatibles.—Morphine, chloral, amyl-nitrite, alcohol, chloroform, and ether are physiological antagonists. The most direct opponents are chloral and morphine.

Cocaine is incompatible with caustic alkalis and the alkaline carbonates and bicarbonates, as well as with bichloride of mercury, iodine and the iodides, ammonia, zinc chloride, and borax.

Synergists.—Medicinally, its cerebral effects may be enhanced by the cerebral stimulants, such as alcohol, cannabis Indica, and belladonna, while its analgesic and anesthetic action may be aided by carbonic acid, atropine, opium, and conium. When used as a mydriatic, atropine serves as a valuable synergist.

Physiological Action.—For our first knowledge of the physiological properties of coca we are indebted to its empirical use among the natives of Peru. The history of the drug is replete with interest and romance. It was regarded as the living representation of the Deity, the ground whereon it grew being held sacred. During the reign of the Incas its use was a royal privilege, the people being compelled to obtain permission from the governor to avail themselves of its benefits. Later it was adopted indiscriminately.

The native *coquerros* (coca-chewers) have learned from experience that they can climb the Andes, work laboriously in the mines, and endure fatigue and hunger more hardily when chewing the leaves of the plant, and from time immemorial the drug has been recognized by observers as possessing powerful nutritive, stimulant, and restorative properties.

In describing the action of the crude drug the author can add little to the words of Linnæus, who long ago wrote that coca possessed "the penetrating aroma of vegetable stimulants, the astringing and fortifying virtues of an astringent, the antispasmodic qualities of bitters, and the mucilaginous nutritive properties of analeptics or of alimentary plants." "This leaf," he adds, "exhibits with energy its action on all parts of the animal economy."

Since the isolation of the alkaloid cocaine, to which the drug owes its physiological and medical properties, by Gaedeke in 1855, and the subsequent study of it by eminent pharmacologists and therapeutists, we have learned more of the physiological action of coca. Its effect upon different systems are here described in detail.

Externally and Locally.—Cocaine is analgæsic, anesthetic, and ischemic. Upon the unbroken skin it has no action, but upon

mucous membranes or the subcutaneous tissue it produces complete local analgesia. The surface to which it is applied becomes paler than normal, owing to contraction of the blood-vessels, but afterward reddens and appears turgescient through secondary dilatation of the vessels. The absorption of the drug by mucous membranes varies with the locality to which it is applied—with difficulty from the conjunctiva, yet with great readiness from the Schneiderian membrane, producing its characteristic constitutional effect.

Applied to the conjunctiva, or even taken internally, cocaine causes a transitory contraction of the pupil, soon followed by dilatation. The accommodation is impaired, but not completely destroyed. The ocular tension is lowered. The light reflex is not abolished. There may be a slight exophthalmos.

The analgesic action of cocaine applied locally is due to the depression of the ends of the nerves of pain-sensation. It does not affect the ordinary sensations of touch or temperature to anything like the extent that it affects pain-sensation. It dilates the pupil by stimulating the ends of the sympathetic nerve, which innervates the radiating fibers of the iris.

In addition to its local analgesic action the drug possesses the power of destroying the functions of the nerves of special sense, so taste and smell are abolished. When applied locally or taken internally it primarily checks many of the secretions, though those from the pancreas and liver seem to be uninfluenced by its internal use. The secondary impression of cocaine, however, when the blood-vessels become dilated, is accompanied by increased secretions.

Internally—Digestive System.—Although it has been shown by experiments upon animals that cocaine is incapable of sustaining life, it diminishes in man the sensation of hunger, owing to its local anesthetic action upon the mucous membrane of the stomach, so that the *coqueros* and the modern habitués are able to abstain from food for days, thirst also being allayed. This diminution of hunger does not seem to impair appetite and digestion until habitual cocaine mania destroys the gastric functions almost entirely. This contributes to the great emaciation of these patients.

On account of its stimulant action upon the constrictor fibers of the great sympathetic nerve, under the influence of moderate doses peristalsis is largely increased in the stomach and intestines, very large or poisonous doses, on the contrary, causing great sluggishness of the bowels.

Circulatory System.—Medicinal doses of cocaine increase the force and frequency of the cardiac contractions, and also arterial pressure. Large or poisonous doses render the pulse slow, soft, and weak and lower arterial tension. The exact *modus operandi* is not fully determined, but there is direct stimulation of the heart or its accelerator mechanism. There is a marked rise in blood-pressure due to the cardiac stimulation and to a marked contraction of the blood-vessels from vasoconstrictor stimulation.

Nervous System.—When given internally its first action is upon the cerebrum, moderate doses greatly stimulating the intellectual faculties and producing a feeling of ecstasy and well-being, in many respects akin to the sensations experienced under the action of cannabis Indica. In the course of a few hours the stage of cerebral excitement is succeeded by mental, moral, and muscular depression. The motor cortex is also stimulated, causing increased muscular excitement or restlessness. Garrulousness is usual.

Large doses result in incoherent speech and wild delirium, accompanied by swaying of the head, followed by epileptiform convulsions and narcosis. The convulsions are partly of cerebral or of basal ganglionic origin. There is a distinct increase in the ability to carry on mental labor.

The medulla is markedly stimulated where a distinct action on the centers of breathing and of circulation is manifested.

The sensory nerves are depressed by small and paralyzed by lethal doses. The motor nerves are also depressed by large doses, this action, however, being subordinate to that exerted upon the sensory nerves. The muscles are stimulated by medicinal doses through impression upon the motor tracts, although large doses greatly depress muscular activity. The chewing of coca, as practised by the natives of Peru and Bolivia, undoubtedly appears to augment muscular strength and powers of endurance.

Mosso claims that small doses of cocaine serve as a powerful muscular stimulant in cases of exhaustion from hunger or fatigue. The analgesia produced is largely responsible for the sense of muscular power. Tire is not felt as its physiological accompaniment.

Respiratory System.—Medicinal doses powerfully stimulate the respiratory center, increasing the rapidity and depth of the respirations. Poisonous doses paralyze the center, the result being dyspnea, slower, feeble breathing, and death from respiratory failure, usually ushered in by convulsions, and often Cheyne-Stokes rhythm.

Absorption and Elimination.—Cocaine is quickly absorbed, being eliminated principally by the kidneys in a form differing from its original nature. Much of it probably undergoes oxidation in the body. The amount of urine is increased, though the nitrogenous elements are diminished. The habitual use of the drug lessens urinary secretion.

Cocaine possesses no cumulative action. Metabolism is slightly increased by the augmented muscular activities, but the exact relations of cocaine to metabolism are not yet available.

Temperature.—Medicinal doses have no influence on bodily heat, but poisonous doses usually raise the temperature, owing, according to Reichert, to an increase of heat-production.

Eye.—Cocaine produces a noticeable dilatation of the pupil, as already explained under "Local Action," the maximum change being reached in about an hour, and the normal state regained in from twelve to twenty-four hours.

owing to its power of coagulating albumin, and thereby being less readily absorbed. It is also more agreeable to the taste. While it does not produce anesthesia so readily as the hydrochlorate, its effect is more permanent, and, in addition, it possesses powerful antiseptic properties. By many physicians it is preferred in laryngological work.

Internally.—COCA has been successfully used in *gastralgia* and to *improve the digestion*. COCAINE is frequently an efficient remedy in *sea-sickness* and to *allay excessive vomiting*.

Bartholow has highly recommended the drug in *chorea*, *asthma*, *paralysis agitans*, and *alcoholic*, and *senile tremor*. It has also been suggested as a cure for the *opium*, *alcohol* and *tobacco habits*.

Spinal Analgesia.—Within recent years the use of cocaine, thrown into the spinal cord, has been very widespread. It was first pointed out by Corning, of New York, a number of years ago, that the injection of cocaine into the spinal nerve-roots would induce analgesia of the lower limbs, but little practical use was made of this suggestion. Bier, of Kiel, rehabilitated the procedure, adopting the newer points of technic brought out by Quincke in his observations on lumbar puncture, and performed major operations below the umbilicus during the analgesia conferred by the drug. Tuffier, Murphy, Fowler, Bambridge, Reclus, and many others have supplemented the early observations, and at the present time there is a large literature concerning the intrarachidian injections of cocaine in surgery. Many operations, heretofore impossible to perform by reason of accompanying cardiac or renal disease, thus making the employment of ether or chloroform unwise, have been done successfully under cocaine analgesia. In many respects an ideal has been reached, but there are a number of drawbacks to its use here. Headache, nausea, vomiting, great prostration, and weakness, accompanied by dizziness, have been noted with varying constancy as following the use of the drug in this manner. Its use, therefore, presents some questions of expediency that subsequent experience must answer.

A logical outcome of the use of cocaine in this manner in surgery is its use in persistent neuralgias—sciatic and others. These have been relieved in many instances, most often to return, yet at times not. The pains of *tubes* have also been markedly relieved by the same procedure.

Time and experience alone will determine what the subsequent developments may be along these lines.

SIMILAR PRODUCTS.—In coca leaves there are other cocaines, and still others are made synthetically from the ecgonine base, but these have not been used to any great extent. *Cocainine*, *benzococainine*, *tropacocaine* have been used sparingly. The last has been employed in spinal analgesia in the place of cocaine.

EUCAINE.—Alpha and beta-eucaine are newer artificial alkaloids used as substitutes for cocaine. They differ from cocaine in that they may be subjected to boiling and are not thereby decomposed. Moreover, they are less toxic and have about equal

analgesic properties. Beta-eucaine is to be preferred, as it is less irritating. On the eye, they do not dilate the pupils so widely and are capable of extensive employment in ophthalmic practice.

Holocaine is a synthetic derivative from phenacetine, used widely in ophthalmic practice for much the same purposes. It is not so satisfactory in many respects.

ORTHOFORM— $C_6H_5OH(NH_2)(COOCH_3)$ —meta-amidopara-oxybenzoic-acid methyl ester, is another product of radically different chemical composition, being derived from benzoic acid. It possesses many of the analgesic properties of cocaine. It is a white, slightly soluble powder, and is useful as a dusting-powder, proving antiseptic and analgesic at the same time. It is extensively used in the treatment of ulcers—rectal, urethral, laryngeal, gastric, etc.—of tuberculous, syphilitic, or carcinomatous origin, and offers excellent opportunities as a local analgesic, as it remains in contact for a considerable space of time because of its comparative insolubility.

ANESTHESIN— $C_6H_5NH_2COOC_2H_5$ —ethyl para-amido-benzoate, is a similar body of like properties with the same general indications.

STOVAIN is a recent (1903) addition to this group. It is a derivative of tertiary amyl alcohol; it crystallizes in little brilliant flakes, resembling cocaine. Its action in some instances is just as efficient as cocaine, in others nearly so. It is most certainly much less toxic, and therefore can be given in larger doses if required.

The following salts of cocaine have been manufactured and are used for much the same purposes as the hydrochloride and in the same dosage: Cocaine aluminium citrate, sulphate, borate, canthanate, lactate, nitrate, phenate, saccharate, salicylate, and stearate. *Cocapyrine* is a mixture of cocaine and antipyrine, 1 : 100.

Contraindications.—No special or distinct contraindication to its use exists. In diseases of the kidneys with diminished urinary flow it should be cautiously administered, lest total anuria ensues. With subjects suffering from weak or diseased heart, caution is to be used, as collapse has been frequently noted.

Administration.—For hypodermic use, solutions of from 2 to 5 per cent. are generally employed.

It should be noted that children and females require smaller doses of the drug.

It is altogether possible that many of the coca wines on the market contain varying quantities of cocaine. The reckless and indiscriminate prescription of these preparations, therefore, is liable to induce the cocaine habit. It is questionable, indeed, whether the administration of cocaine with a view to curing the intemperate use of opium, alcohol, or tobacco is wise. It frequently happens that patients thus treated lose their craving for the latter drugs only to acquire an inordinate appetite for cocaine, which, as has been shown, is possibly as dangerous as either of them, in its physical and moral effects.

DRUGS ACTING CHIEFLY ON THE CIRCULATORY ORGANS.

THERE is a large group of drugs which, like many of the foregoing, show marked pharmacodynamic action on several tissue systems of the body, and hence on more than one physiological function. Their chief use, however, is to modify, in some definite manner, the circulatory apparatus. They either bring about a marked regulating action on the rhythm of the heart and act on the vessels, as digitalis, or act almost alone on the blood-vessels, as adrenalin or ergot: still others acting purely as reflex stimulants to the heart action, as many of the xanthines, or act distinctly as cardiac depressants, as aconite.

These will be here taken up as a series of groups of drugs with which one can modify the conditions of the circulation. A large number of other factors enter into their full physiological activities, but these are laid aside for the moment.

In this present instance these remedies will be grouped as follows: (1) The Digitalis group, composed largely of drugs that exert a predominant stimulant action on the vessel walls, on the heart walls, and on the cardio-inhibitory apparatus; (2) Adrenalin group, in which the chief activity is exerted on the tissues of the walls of the blood-vessels; (3) the Xanthine or Caffeine group, (4) the Nitrite group, in which the main action consists of vessel dilatation; and (5) the Aconite group, in which heart-muscle and heart-ganglion depression are prominent and vasodilatation is pronounced.

It is preferred to eliminate the terms cardiac stimulants and cardiac depressants, hoping that the student should have in mind the general agents at his command to regulate the circulation, if such regulation is called for in treatment. As opportunity offers, the circulatory action of a number of the drugs already discussed under other headings will be considered. Thus, while alcohol exerts its main action on the nervous system, it plays an immensely important rôle as a remedy to modify cardiac and circulatory activity.

THE DIGITALIS GROUP.

In this group are classed *Digitalis purpurea*, *Strophanthus Kombé*, and *S. hispidus*, *Convallaria majalis*, *Urginea Scilla*, *Helleborus niger*, *Apocynum cannabinum*, *Adonis vernalis*, *Nerium oleander*, *Erythrophloeum Guinense*, and a few others.

It is noteworthy that the active principles in these drugs are glycosides, and while their chemical composition may vary considerably, their pharmacological actions are very similar.

Digitālis—Digitālis—Digitalis. U. S. P.

(FOX-GLOVE.)

Origin.—The dried leaves of *Digitalis purpurea* L., collected from plants of the second year's growth at the commencement of flowering. The plant is a biennial, 2 to 5 feet (0.6-1.5 M.) high, indigenous in Southern and Central Europe, and growing wild as far north as Norway. It is also found in Madeira and the Azores, and is well known everywhere as an ornamental garden plant.

Description and Properties.—Leaves 4 to 12 inches (10-30 Cm.) long, ovate or ovate-oblong, narrowed, with a petiole, crenate, dull green, densely and finely pubescent, wrinkled above, paler and reticulate beneath, mouth-broad near the base, odor slight, somewhat tea-like; taste bitter, nauseous. The leaves of mullein, *Isatis cretica* and *Isatis Helicum*, are sometimes mixed with those of fox-glove.

The study of the active principles is fraught with much difficulty, and at the present time it is by no means certain what all of the active bodies are. The following are among the most important constituents: *Digitalin*, $C_{27}H_{44}O_{11}$, a crystalline glycosidal substance, insoluble in water. *Digitalin* is found mostly in the seeds. *Digitonin*, $C_{57}H_{100}O_{24}$, is another constituent found in greater abundance in the seed, but also present in the leaves. It is a white, powder-like glycoside resembling saponin. It is soluble in water and insoluble in alcohol. A watery solution is capable of holding the water-insoluble glycosides in solution or in suspension. It is an active diuretic principle. *Adonin*, $C_{27}H_{44}O_{11}$, is the chief glycoside of the leaves and the most active constituent of the plant. It is insoluble in water, soluble in alcohol, chloroform, and ether. *Scrophularin*, $C_{27}H_{44}O_{11}$, is another glycoside derived from the leaves. It resembles *adonin*. *Digitiden* and *adonin* are also present, but are of less importance.

Dose.— $\frac{1}{2}$ -2 grains (0.03-0.12 Gm.) [1 grain 0.065 Gm.], U. S. P.]

Official Preparations.

Extractum Digitalis—**Extracti Digitalis**—**Extract of Digitalis**.—**Dose**, $\frac{1}{2}$ -1 grain (0.03-0.06 Gm.) [$\frac{1}{2}$ grain 0.03 Gm.], U. S. P.]

Flüidextractum Digitalis—**Flüidextracti Digitalis**—**Fluidextract of Digitalis**.—**Dose**, 1-2 minims (0.05-0.12 Cc.) [1 minim (0.05 Cc.)], U. S. P.]

Infusum Digitalis—**Infusio Digitalis**—**Infusion of Digitalis** (1 per cent).—**Dose**, 1-4 fluidrams (3.7-15 Cc.) [2 drams (8 Cc.)], U. S. P.]

Tinctura Digitalis—**Tinctura Digitalis**—**Tincture of Digitalis** (40 per cent).—**Dose**, 5-20 minims (0.3-1.2 Cc.) [15 minims (4 Cc.)], U. S. P.]

Unofficial Preparations.

Digitalinum—**Digitalini**—**Digitalin**.—**Description and Properties**.—An amorphous, yellowish white, crystalline powder or scales, or light, white crystalline tufts of needles, odorless and of an intensely bitter taste. Insoluble in water, soluble in alcohol.—**Dose**, 1-15 grains (0.06-0.96 Gm.)

Digitoxin—**Digitoxin**—**Digitoxin**.—**Description and Properties**.—A white crys-

lathine body, of a bitter taste, insoluble in water, soluble in chloroform.—*Dose*, $\frac{1}{16}$ – $\frac{1}{8}$ grain (0.0003–0.0006 Gm.).

Antagonists and Incompatibles.—The most complete antagonist is saponine, the active constituent of *Saponaria officinalis*. The cardiac depressants antagonize the action of digitalis upon the heart, morphine and the emetics possessing a similar property, though in less degree.

The incompatibles are the ferric chloride and sulphate, preparations of cinchona, tannic acid, and preparations containing it, and the subacetate and acetate of lead.

Synergists.—The cardiac action of digitalis is aided by other members of this group, and also by belladonna and ergot.

Physiological Action.—*Externally and Locally.*—Digitalis is at first irritant to the skin and mucous membrane. Later it may paralyze the sensory end-organs and thus prove an analgesic. Digitoxin seems to be the most active constituent in causing the irritant action.

Internally.—Digestive System.—Small doses ordinarily produce no effect upon the stomach. Large doses act as a gastro-intestinal irritant, exciting nausea, vomiting, and diarrhea. These effects may follow the prolonged administration even of small doses.

Circulatory System.—The principal effects of digitalis are upon the circulatory apparatus, the action of the drug varying according to the size of the dose.

In discussing the action of digitalis on the circulatory apparatus, both the results on the heart and on the blood-vessels need considering. So far as the heart is concerned two important factors should be borne in mind: the heart-muscle itself, and the cardiac regulating apparatus, particularly the vagus inhibitory action. Digitalis, as well as all the members of the series, exerts a markedly irritant action on heart-muscle; it also acts, as has been pointed out, as a distinct primary irritant and stimulant to the medulla, hence on the vagus nucleus. There is a play between these two factors, and the effects of digitalis on the heart are to be interpreted in accordance with the respective influences of these two conditions.

Very small doses of digitalis show practically only the results of mild muscle-stimulation. They cause, particularly in susceptible individuals, a slight increase in the force and rapidity of the heart-action.

Larger doses, and especially when repeated, bring out the so-called "therapeutic action" of digitalis. As the heart-muscle feels the stimulation before the vagus center is affected, there is usually, under medicinal doses, a preliminary increase in the rapidity of the heart's action, as well as a distinct increase in its force. In from three-quarters to one hour after giving a medicinal dose the second factor, inhibition, from vagus stimulation, becomes apparent, in some cases it may take several hours fully to estab-

lish the vagus action; then the heart-rhythm becomes slower, the force is increased, the systole is more complete and effective, and usually a larger amount of blood is being pumped every hour throughout the body, and also into the body of the heart-muscle itself.

This condition of increased tone may be held by judicious use of digitalis for considerable periods of time. Should the limit of safe dosage, however, be overstepped, the poisonous action of digitalis may appear. This poisonous action has been interpreted in a variety of ways, but it would appear that two explanations alone are tenable, perhaps only one. It has been held that one of the first results of poisoning is a partial paralysis of the vagus center, this would let up on the inhibitory rein on the heart and it would commence to beat faster, being still stimulated as to its muscle; further loss of inhibitory control would cause arrhythmia, and the end result would be a rapid, irregular heart with loss of tone and final exhaustion.

It has been shown, however, in some instances, and these are yet too few to be positive concerning the matter, that artificial vagus stimulation is effective in slowing the heart even in the last stages of poisoning. Should this be interpreted that the vagus centers are not exhausted by digitalis, in order to explain the symptoms noted, it must be assumed that the muscle stimulation has become so excessive that even the vagus inhibition is ineffectual in controlling it, hence the rapid irregular heart-action is a result of intense muscle irritability brought about by the members of this series. According to this view there is, in the final stages of poisoning, a distinct *delirium cordis* set up which the vagus inhibition is unable to control. This brings about the arrhythmia, loss of efficient contractions, and finally exhaustion with marked diastolic relaxation.

The action of digitalis on the blood-vessels is marked. It causes in therapeutic doses a distinct stimulation of the vasoconstrictors with an increase in the arterial tension. An action on the muscles of the arteries themselves augments this central action, probably antedates it. In poisoning the blood-pressure usually falls, but it is apt to be extremely irregular; final toxic stages are invariably accompanied by loss of pressure, both in the interior and in the extremities.

Nervous System.—This is primarily and markedly stimulated. In small doses this action is limited to the medulla in the inhibitory cardiac and vasoconstrictor centers; large doses cause a more extended medullary excitation, with nausea and vomiting, convulsions, and increased respirations; toxic doses induce central motor convulsions, which are not due to cerebral anemia, since they may develop while the circulatory blood-supply is ample.

Absorption and Elimination.—Digitalis is more rapidly absorbed than eliminated, the elimination probably taking place by the kid-

neys. Cumulative action, so called, may take place if the drug is not properly administered.

Kidneys.—Digitalis was introduced into modern practice because of its action as a diuretic.

This diuretic action is due largely to the increase of blood-pressure in the glomeruli of the kidneys, being therefore more pronounced in conditions in which low arterial pressure is maintained at the same time. Very large doses, instead of increasing the amount of urine, may diminish or even wholly suppress it.

Metabolism.—This is increased by reason of the increase in the general circulation. With increased blood-pressure the amount of nitrogen elimination is increased, as is also the quantity of CO₂ given off. If the blood-pressure is not raised by the drug, the increase of these is not noted.

Temperature.—Medicinal amounts have no appreciable effect upon the temperature; large doses cause a reduction of bodily heat in febrile conditions, while toxic doses reduce temperature even in health. The action of digitalis upon the circulatory system is retarded by high temperature.

Eye.—Medicinal amounts have no effect. Large or poisonous doses may cause dimness of vision, amblyopia, diplopia, or mydriasis. In a case of poisoning by digitalis recorded by Jeanton there was xanthopsia for two days.

Uterus.—Large doses stimulate contraction in the uterine muscles.

Untoward Action.—Erysipelatous and papular eruptions have been produced by the drug, there having been also observed nausea and a feeling of weakness in the stomach, dimness of vision, headache, heaviness of the head, sleeplessness, and debility.

Poisoning.—Toxic symptoms may occur either from the ingestion of a single poisonous dose or the accumulation of the drug under prolonged administration.

In the more marked cases of poisoning from overdosage there are marked disturbances of the gastro-intestinal tract, abdominal pains, vomiting and purging. The pulse may at first be slowed down to 40, to be followed in the stage of collapse by a rapid, irregular, and compressible pulse—often imperceptible at the wrist—and syncope, more frequently occurring when the patient is raised up.

Other symptoms are—feeble respiration, dilated pupils and occasionally double vision, headache, delirium and stupor, and possibly convulsions just before death, which result from medullary excitation. Digitalis is not a rapid poison, the fatal collapse being usually deferred from ten to forty-eight hours.

The symptoms indicative of the cumulative action of digitalis are usually gastric irritability, headache, and dizziness. These are associated with a feeling of fulness in the vessels, particularly in the temples, by weakness in the pit of the stomach, and by a tendency to syncope. There may also be ringing and buzzing in the ears, and disturbances of sight and hearing.

Poisonous doses are difficult to determine. One teaspoonful of the leaves, as an infusion, and 40 grains of the powder, have caused death, whereas ten times as much in infusion and 80 grains of the powder have not produced fatal results. The extract in 20-grain doses has been lethal, as have also 2 ounces of the tincture. Digitoxin in $\frac{1}{3}$ grain (0.02 Gm.) has been deadly, and the commercial digitalins have caused serious results in doses of from $\frac{1}{2}$ -1 grain (.030-.060 Gm.).

Treatment of Poisoning.—Lavage of the stomach should be immediate, emetics being too depressing if the heart is already affected by the poison. A solution of tannic acid should be introduced into the stomach as the best chemical antidote. Diffusible stimulants may be required, the horizontal position should be maintained, and external heat applied, particularly to the abdomen. Absolute rest is imperative. The patient should not be allowed even to raise his hand or his head from the bed.

Therapeutics.—Externally and Locally.—Digitalis is of little service externally.

Internally.—DIGITALIS is one of the most important drugs known to medicine. The remedy is indicated in deranged conditions of the circulatory system itself, and, moreover, where, although the circulatory mechanism be normal, an abnormal state of other organs may be improved by changing the circulation in them. Digitalis is indicated in any case where there is actual failure in the dynamic power of the heart-muscle, irrespective of the nature of any primary valvular lesion inducing the hyposystolic condition.

Of course the rational use of the drug presupposes the absence of extensive fatty degeneration or interstitial myocarditis, since, should these conditions be advanced, there is danger of producing permanent asystole. It is difficult to estimate the integrity of the heart-muscle, and many cases presumably intolerant of the drug bear digitalis well.

In all conditions, therefore, in which there is insufficient driving power in the muscle with the usual accumulation of blood in the veins, digitalis is useful. As it improves the blood-supply of its own fibers it therefore aids in restoring tone to itself, and may even so increase its own power as to render the drug unnecessary.

With regard to the specific effect of the drug upon the heart-muscle this is not true, since the influence of the drug lasts but a few days, indirectly, through the additional muscle-power developed during a few weeks' administration. During or after middle life, if the vascular tension be increased, and especially if there be any sclerosis of the vessels, the administration of digitalis should be combined with that of vasodilators, to prevent contraction of the vessels and consequent increase of peripheral resistance. Of these adjuncts, opium is valuable. The nitrates are also of service.

In *mitral regurgitation* digitalis is an exceedingly efficient remedy. In this not infrequent lesion there is a deficiency of

blood in the systemic arteries, and consequently an overaccumulation in the pulmonary vessels and systemic veins. Owing to this venous hyperemia, there is congestion of the lungs, stomach, liver, and the entire digestive tract, together with the attendant symptoms—dyspnea, bronchitis, deranged digestion, constipation, edema, etc.

Digitalis by improving the pumping power of the heart equalizes the circulation, fills the systemic arteries, and relieves the venous congestion with its accompanying symptoms.

Digitalis is valueless in the presence of compensatory hypertrophy, but after *dilatation* occurs is wonderfully effective, the size of the heart being often perceptibly diminished by a proper administration of the drug.

Digitalis may act indirectly as a tonic by improving the nutrition of the heart through the prolonged diastole and contraction of the cardiac muscle it occasions. The longer the period of diastole, the more time is allowed for the coronary arteries to fill and nourish the heart by the better blood-supply. The increased arterial tension produced by the drug causes the blood to be sent into the coronary arteries with greater force during the cardiac diastole.

The forcible contraction of the heart occasioned by this drug expels the blood from the veins of the cardiac muscle, improved nutrition of the muscle resulting from this mechanical action.

There has been some objection to the use of digitalis in cardiac ataxia resulting from *aortic regurgitation*, on the ground that the latter action is more forcible and extensive under its influence. The author's experience is that cases of aortic regurgitation respond to the use of this drug as promptly as any other lesion, save that it is at times necessary to give larger doses than are required in other valvular affections.

In many valvular diseases of the heart there is marked irregularity, such often being more serious than the mere leakage of blood. Digitalis by stimulating the vagus and motor ganglia causes the heart to beat more regularly. The drug is, therefore, of great service in *exophthalmic goiter*.

In any condition of low arterial tension, whether resulting from *infection*, *general debility*, or whatever cause, digitalis, by increasing the force of the heart and raising arterial pressure, serves a useful purpose.

In *collapse from shock*, *poisoning*, or *cholera*, where the great veins are dilated, it has proved an efficient agent, but it must be used in conjunction with more active and quick stimulants, such as alcohol, ether, nitrites, etc.

The functional activity of the various organs in *anemia* and other deranged conditions of the system may be improved by the administration of this remedy.

The circulation being improved, there is increased absorption of fluid from the tissues, as well as greater circulation of fresh intercellular fluid, favoring combustion and functional activity, while the

waste products are more readily removed. This action renders digitalis valuable as a tonic.

In *pneumonia*, particularly if there is an irregular, fluttering heart, and evident signs of toxic action, it is of the greatest importance, being of use here to stimulate the contractile force of the cardiac muscle when the intraventricular pressure becomes stronger than the unaided muscle can resist, and dilatation is imminent, if not already begun.

In *congestion of the lungs* during the course of *exhausting fevers*, such as *typhoid*, and in the first stage of *meningitis*, *bronchitis*, *cellulitis*, etc. before transudation takes place, it is considered by many physicians to be a valuable remedy in relieving the venous stasis. It is particularly valuable, combined with squill, in many cases of *chronic bronchitis*, particularly of cardiac origin.

Many observers of wide experience have recommended large doses of digitalis in *delirium tremens*. It is wonderfully effective in this condition, particularly where there is low arterial pressure. Small doses are more beneficial than large ones.

Digitalis has been successfully employed in *acute mania* and *epilepsy*, Gowers recommending it in the latter disease as an adjuvant to the bromides, associated with belladonna. It is fair to state that in maniacal conditions the preponderance of testimony is in favor of large doses— $\frac{1}{2}$ to 4 fluidrams (1.8–15.0 Cc.) of the tincture.

The drug is thought to enhance the influence of ergot in *post-partum hemorrhage*, and when associated with iron it is of value in *purpura hemorrhagica*.

The drug, combined with ergot or potassium bromide according to the indications, has been successfully employed in *spermatorrhœa*, and *nocturnal emissions*.

It is said that absorption of *pleuritic effusion* is hastened by the continued administration of digitalis.

Clifford Allbutt recommends it in sufficient doses to reduce the pulse to 45 or 50 in *aneurism*. This method of treatment, however, has not been widely adopted.

The remedy is invaluable as a diuretic to relieve *cardiac* or *renal dropsy*, its efficiency being more apparent in the former variety, although acute renal dropsy usually yields to its influence. Digitalis, especially combined with squills, is particularly valuable in all dropsies accompanied by lowered arterial tension. Should the renal structure be impaired, the drug is less serviceable, although, when combined with other appropriate remedies, it is decidedly beneficial in *chronic Bright's disease* with cardiac dilatation. In the early stages of the malady, accompanied by cardiac hypertrophy and high arterial tension, it is doubtful whether digitalis is indicated, either alone or in combination.

In conclusion, it should be stated that digitalis is recommended by all authors in every valvular disease of the heart, with the possible exception of aortic regurgitation, some writers supposing it to be harmful in this condition because of the prolonged diastole it

occasions. The more recent clinical views would seem to show that even this valvular affection is not a contraindication.

Contraindications.—*Digitalis* should not be given when there is marked degeneration of the heart-muscle or of the arterial walls. In simple hypertrophy, apoplexy, high arterial pressure, or vascular excitement the use of the drug is inadvisable. Many physicians regard aneurism as a contraindication to the use of *digitalis*.

Administration.—Any of the official preparations may be given, or the powdered leaves in pills or capsules—not at too frequent intervals, however, from four to eight hours elapsing between the doses, lest the drug accumulate in the system, producing poisonous symptoms.

When *digitalis* has been administered for some time to a patient suffering from ascites, and the fluid is removed by paracentesis, poisoning may ensue. It is well, therefore, to discontinue the remedy for two or three days before tapping the patient.

The rapidity of the drug's action upon the heart depends upon the presence or absence of a febrile state. The stimulant action upon the heart is usually observable in from twenty-four to thirty-six hours. The effects of the drug commonly continue from three to seven days after its discontinuance.

The powdered *digitalis*, though the most irritant to the stomach, fully represents the drug, which is true of none of the preparations.

The infusion of *digitalis*, being an aqueous preparation and containing, therefore, a larger proportion of digitonin, is superior for diuretic purposes; while the alcoholic preparations, like the fluid-extract and tincture, being richer in digitalin, digitalin, and digitoxin, are preferable when an action upon the heart is desired.

Ordinarily, therefore, *digitalis* should be given in solution, the tincture and infusion being the most reliable preparations, care being taken in the selection of the crude drug, upon the character of which the strength of the preparation depends.

In uncomplicated cases of cardiac failure, the result of valvular lesion, the tincture is most eligible. In cardiac failure associated with, or resulting from, kidney lesions the infusion, combined with some other diuretic, should be used.

As to the cumulative effect of *digitalis*, so much feared by the older writers on its action, the evil may be ascribed to improperly selected cases or faulty administration. Under proper conditions the drug may be given for months without ill effect.

Of the active constituents, digitalin is usually preferred, as it is so quickly soluble that its effects are manifested a few minutes after its administration, it possesses the full power of *digitalis* in its influence on the heart, with a minimum of its vasoconstrictor action.

Strophanthus—Strophanthi—Strophanthus.**U. S. P.**

Origin.—The ripe seed of *Strophanthus Kombé* Oliver, deprived of its long awn. The plant is a woody climber, ascending to the tops of high trees, from which it hangs in festoons. It is found in tropical Africa, where it and other species of *strophanthus* are used to prepare arrow poisons termed *kumbé, Inze, Inzege, etc.*

Description and Properties.—The seeds are about $\frac{1}{8}$ inch (15 Mm.) long and $\frac{1}{4}$ to $\frac{1}{2}$ inch (4-5 Mm.) broad, oblong lanceolate, flattened and obtusely edged, grayish green, covered with appressed silky hairs, one side extending into the attenuated, pointed end; kernel white and oily, consisting of a straight embryo having two cotyledons, and surrounded by a thin layer of perisperm; nearly inodorous; taste very bitter.

Many of the species of *strophanthus* contain a glycoside, *strophanthin*, upon which their medicinal properties depend. Feist has also isolated a pseudostrophanthin. Strophanthidin is also described as a separate glycoside found in some of the seeds. It also contains kombéic acid. Another active principle, *ouabain*, is obtained from a related species of *strophanthus*.

Dose.—1 grain (0.065 Gm.), U. S. P.

Official Preparation.

Tinctura Strophanthi—Tinctura Strophanthi—Tincture of Strophanthus (10 per cent.).—**Dose,** 4-10 minims (0.12-0.6 Cc.) [8 minims (0.5 Cc.), U. S. P.]

Strophanthinum—Strophanthini—Strophanthin.**U. S. P.**

Definition.—A glucoside, or mixture of glucosides, obtained from *strophanthus*.

Description and Properties.—Strophanthin is a white or faintly yellowish crystalline powder. It is permanent in the air and has an intensely bitter taste. It is very soluble in water and diluted alcohol. Its solutions decompose very readily.

Dose.—Average dose, $\frac{1}{160}$ grain = 0.003 Gm. (0.3 milligramme), U. S. P.

Antagonists, Incompatibles, and Synergists.—The same as for digitalis.

Physiological Action.—*Externally and Locally.*—The tincture of *strophanthus* has no local action of importance. Strophanthin and ouabain, however, possess marked sedative properties, the latter being much the stronger. They paralyze the ends of the sensory nerves and are active local anesthetics.

Internally.—**Digestive System.**—*Strophanthus* is similar in its action to digitalis, though less apt to disturb digestion in small doses, on the contrary, its bitter taste tends to improve the appetite.

Circulatory System.—Upon the heart its action is identical with that of digitalis, though differing from the latter drug in its effect upon arterial tension and the arterioles. Strophanthus does not contract the arterioles so markedly, and the arterial pressure is but slightly raised, the elevation being due to the increased force of the heart. Its action is more rapid than that of digitalis, results being produced in fifteen to twenty minutes after taking.

Nervous System.—Strophanthus affects the nervous system even less than digitalis. Kobert claims that it is a slight sedative to the brain and spinal cord.

Respiratory System.—It has no important action.

Absorption and Elimination.—Strophanthus is rapidly absorbed, and more readily eliminated than digitalis, possessing less cumulative action. It is principally excreted by the kidneys, increasing the amount of urine by the strengthened heart's action. Unlike digitalis, the drug has little influence upon the caliber of the renal vessels.

Temperature.—Very large doses of strophanthus cause a slight reduction of temperature, not, however, as marked as digitalis.

Iris.—Excessive doses contract the pupil and increase intra-ocular tension.

Uterus.—It resembles digitalis, though more feeble in its action upon the uterus.

The symptoms and treatment of *poisoning* are similar to those described under Digitalis, although strophanthus is more apt to occasion diarrhea. Cases of poisoning are rare. The symptoms observed have been those of severe digitalis poisoning with unconsciousness, tonic and clonic convulsions, hallucinations, diarrhea, analgesia, myosis, Cheyne-Stokes respiration, and death after four days. The toxic dose has not been determined.

Therapeutics.—Externally and Locally.—STROPHANTHIN has been occasionally employed as a local anesthetic, but the testimony in its favor is hardly sufficient to encourage its use.

Internally—STROPHANTHUS is a cardiac remedy, being indicated in the same varieties of heart disease as digitalis. It is of particular value in *stenosis of the mitral orifice*, having a happy influence in controlling the irregular rhythm, nervous dyspnea, and intermittent pains distinctive of this lesion. The drug is also well adapted in subduing functional irregularities of rhythm in cases of *irritable or tobacco heart*.

Hypothetically, STROPHANTHUS is superior to digitalis in certain stages of *Bright's disease* and *heart failure* of elderly people with slightly degenerated arteries, especially in those patients with pre-existing high arterial tension. It is also hypothetically of greater value in pneumonia than digitalis.

Shoemaker advocates the use of strophanthus in the treatment of *psoriasis*.

While in the majority of cardiac diseases digitalis should be first tried, where it fails strophanthus is the proper recourse. It is a peculiarly efficient drug in the *cardiac diseases of children*, according to the majority of observers being safer than digitalis for young patients.

Contraindications.—The same as for digitalis.

Administration.—Of the preparations of strophanthus, the tincture is preferable, both for convenience and safety. It should not be forgotten, however, that the seeds of strophanthus that come into the American market are very much mixed, and that many preparations are not as reliable as one would hope for. Should strophanthin or ouabain be desirable, a fresh solution is to be preferred.

Convallaria—Convallariæ—Convallaria. U. S. P.

(Lily of the Valley.)

Origin.—The dried rhizome and roots of *Convallaria majalis* L., a stemless perennial indigenous in Europe, Northern Asia, and North America.

Description and Properties.—(Of horizontal growth and somewhat branched, about $\frac{1}{8}$ inch (3 Mm.) thick, cylindrical, wrinkled, whitish, marked with a few circular scars, at the annular joint with about eight or ten thin roots, fracture somewhat fibrous, white, odor peculiar, pleasant, taste sweetish, bitter, and somewhat acid.

Convallaria contains two glycosids, *convallamarin* and *convallarin*.

Official Preparation.

Fluidextractum Convallariæ—Fluidextracti Convallariæ—Fluidextract of Convallaria.—Dose, 5–30 minims (0.5–2.0 Cc.) [$\frac{1}{2}$ minims (0.5 Cc.), U. S. P.].

Antagonists and Incompatibles.—The antagonists are the same as for digitalis; tannic acid precipitates the convallamarin.

Synergists.—The cardiac stimulants enhance its cardiac action; emetics and cathartics aid its emeto-cathartic effects.

Physiological Action.—Almost identical with that of digitalis, but less powerful and possessing no cumulative action. Preparations free from convallarin do not disturb the stomach nor affect the cerebrospinal functions. It is asserted that convallaria has stronger diuretic properties than digitalis.

Convallamarin in some cases has produced, among other untoward symptoms, hemoptysis and dyspnea.

Convallarin is a drastic purgative, and in full doses occasions nausea and gastric pain.

Therapeutics.—CONVALLARIA is used for precisely the same purposes as digitalis. The only advantage it possesses over the latter drug is that it has no cumulative action. By some physicians it is considered superior to digitalis as a diuretic and cardiac stimulant after failure of compensation, the diuresis it occasions persisting for some time after the withdrawal of the drug.

Contraindications.—The same as for digitalis.

Administration.—The fluidextract is the best preparation to use, although the infusion is highly recommended by many physicians. Convallamarin replaces digitalin in its action and uses, but does not disturb the stomach like digitalis, and is slightly laxative. It may be used as an alterant with digitalin in doses of $\frac{1}{2}$ grain (0.005 Gm.).

Adonis Vernalis—Adonidis Vernalis—False Hellebore. (Non-official.)

Origin.—A perennial herb attaining a height of about 10 inches (25 Cm.), indigenous in Europe.

Description and Properties.—It has but little odor and a somewhat acid and bitter taste. The plant contains a glucoside, *adonisverin*, to which it owes its medicinal properties. This constituent is a light-colored, crystalline powder, of a bitter taste, and soluble in water and alcohol. A Japanese species, *Adonis amurensis*, yields a related glucoside, *adonin*.

Dose of Adonidin.— $\frac{1}{2}$ –1 grain (0.003–0.01 Gm.).

Antagonists, Incompatibles, and Synergists.—The same as for digitalis.

Physiological Action and Therapeutics.—The action of adonidin is similar to that of digitalis, save that it is less cumulative.

It is used for the same purposes as digitalis, being peculiarly valuable in relieving the pains of heart disease, and is by some physicians preferred to digitalis in the treatment of *aortic* and *mitral insufficiency*, *cardiac asthma*, and *functional irregularity of the heart*.

Scopārius—Scopārii—Scoparius. U. S. P.

(BROOM.)

Origin.—The dried tops of *Cytisus scoparius* L., a shrub 3 to 6 feet (0.9–1.8 M) high, found in Western Siberia and the greater part of Europe. It is sometimes cultivated, and is occasionally met with wild in some of the Middle and Southern States.

Description and Properties.—Occurring in thin, flexible, branched twigs, pentangular, winged, dark green, nearly smooth, tough, usually free from leaves; odor peculiar when bruised; taste disagreeably bitter.

The constituents of scoparius are *sparteine*, a pyridine alkaloid, similar in composition to cocaine, and a neutral, crystalline principle, *scoparin*, to which the diuretic action of the drug is thought to be due.

Dose.— $\frac{1}{2}$ –1 dram (2.0–4.0 Cc.) in infusion [15 grains (1 Gm.), U. S. P.].

Official Preparation.

Sparteine Sulphas—Sparteine Sulphatis—Sparteine Sulphate.—The sulphate of an alkaloid obtained from scoparius.

Description and Properties.—Colorless, white, prismatic crystals, or a granular powder, odorless, and having a slightly saline and somewhat bitter taste; liable to attract moisture when exposed to damp air; very soluble in water and alcohol.—**Dose**, $\frac{1}{2}$ –2 grains (0.003–0.1 Gm.) [$\frac{1}{2}$ grain (0.01 Gm.), U. S. P.].

Antagonists and Incompatibles.—The antagonists are the same as for digitalis, and tannic acid and potassium iodide are incompatibles.

Synergists.—Digitalis, strophanthus, etc.

Physiological Action.—*Externally and Locally.*—No action observed.

Internally.—**Digestive System.**—Sparteine sulphate acts like bitters in improving the appetite and digestion, large doses, as with digitalis, producing vomiting and purging.

Circulatory System.—Cushny and Matthews claim that the action of sparteine upon the heart and blood-vessels is similar to that of digitalis, and numerous experiments upon animals show that while the drug has a slowing action on the heart, it is not of the type induced by the action of digitalis—i. e., muscle irritation and vagus stimulation.

Nervous System.—Sparteine resembles conium in its action upon the nervous system, depressing the brain and spinal cord, and lowering reflex action through paralysis of the motor nerve-endings. Under toxic doses there is also extreme muscular weakness, often complete paralysis.

Respiratory System.—Medicinal doses produce no effect. Toxic

doses slow and weaken the respiration, death being possible from paralysis of muscles of respiration and asphyxia.

Absorption and Elimination.—It is rapidly absorbed and as readily eliminated, and, unlike digitalis, has no cumulative action. In disease it is an active diuretic, particularly the infusion or fluid-extract or the alkaloid scoparin. Sparteine, on the other hand, is not an active diuretic.

Scoparius therefore increases the flow of urine and the excretion of urea. The drug has a direct action upon the renal structure.

Poisoning—The following symptoms occur: Small, rapid, and irregular pulse, dyspnea, great muscular weakness, incoördination of movement, and muscular tremors, followed possibly by clonic and tonic convulsions, which are replaced by marked depression of the nervous and muscular system, and collapse.

Treatment of Poisoning.—Respiration should be maintained by artificial respiration and by hypodermic injections of strychnine and atropine. Potassium iodide or solutions of tannic acid should be given, and the free use of diuretics or diluents to favor elimination.

Therapeutics.—*Externally and Locally.*—No influence is exerted.

Internally.—SCOPARIUS was formerly used for the same purposes as digitalis. It is serviceable in some cases of *nephritis* with weak, irregular heart-action, and in *chronic Bright's disease* with cardiac hypertrophy and high arterial tension. It is also useful in the nervous, irregular heart of opium habitués. It is also valuable as a diuretic. Like strophanthus, scoparius is of more value in mitral than in other valvular diseases. The drug, while having many enthusiastic advocates, is generally less esteemed than digitalis.

Contraindications.—Practically the same as for digitalis, though less definite.

Administration.—The fluidextract of scoparius may be given or the decoction, made by adding $\frac{1}{2}$ an ounce (16.0 Gm.) of the broom-tops to 1 pint ($\frac{1}{2}$ liter) of water and boiling them down to $\frac{1}{2}$ pint (250 Cc.). Of this, 1 ounce (32.0 Cc.) should be taken every three hours. This decoction is one of the most efficient diuretics in cardiac dropsy.

The sparteine sulphate is usually employed when an action on the heart is desired; it may be administered either hypodermically or in pill, capsule, or aqueous solution.

Cactus—Cacti—Cactus - Night-blooming Cereus.

(*Non-official.*)

Origin. The stems and flowers of *Cereus grandiflorus* L., a plant indigenous in tropical America and frequently cultivated for ornamental purposes.

Preparations.

Flüidexträctum Cacti—Flüidexträcti Cacti—Fluidextract of Cactus.—*Dose*, 5-10 minims (0.5-0.6 Cc.)

Tinctūra Cacti—Tinctūræ Cacti—Tincture of Cactus.—*Dose*, 15-20 minims (1.0-1.2 Cc.)

Physiological Action and Therapeutics.—Cactus differs from digitalis in its less disturbing influence upon the digestive apparatus. Its action upon the circulation is to elevate arterial pressure, render the pulse more regular, and increase the strength and rapidity of the heart's action when given in medicinal doses. Toxic doses, on the contrary, diminish both the blood-pressure and the pulse-rate, rendering the heart irregular in its action and arresting it in systole. Moreover, the reflexes are increased by poisonous doses, death being preceded by clonic and tetanic convulsions of spinal origin.

Cactus helps to steady the distended heart, especially when there is a neurotic element, and is of particular service in relieving precordial distress of myopathic origin. It is useful in functional irregularity of the heart however evidenced. In "tobacco heart," cardiac arrhythmia and palpitation of neurasthenia, and the distressing palpitation from reflex irritation in dyspepsia, cactus is a valuable remedy. In organic disease of the heart cactus, if less generally applicable, is none the less valuable, for it seems to afford the greatest service just where digitalis and strophanthus fail.

DRUGS ACTING CHIEFLY AS VASOCONSTRICTORS.

A number of the group of drugs whose main action is on the organs of circulation act, in some respects, like the digitalis group, but instead of exerting their main action on the heart-muscle, their chief activity is manifest on the arteries and unstriated muscle in general. The most important of this series are ergot and the suprarenal extracts. Hydrastis and gossypium may be included in this category, but their action is much weaker.

Ergōta—Ergōtæ—Ergot. U. S. P.

Origin.—The sclerotium of *Claviceps purpurea* (Fr.) Tulane (Fungi), replacing the grain of rye, *Secale cereale* L. Most of the commercial article comes from Spain and Russia.

Description and Properties.—Somewhat fusiform, obtusely triangular, usually curved, about $\frac{1}{4}$ to $\frac{1}{2}$ inches (2-3 Cm.) long and $\frac{1}{8}$ inch (3 Mm.) thick, three-furrowed, obtuse at both ends, purplish-black, internally whitish, with some purplish streaks, breaking with a short fracture; odor peculiar, heavy, increased by trituration with potassium or sodium hydrate 10%, taste oily and disagreeable. Old ergot, which breaks with a sharp snap, is almost or entirely devoid of a purplish tinge in the fracture, is hard and brittle between the teeth, and comparatively odorless and tasteless, should be rejected.

Ergot should be but moderately dried and preserved in a closed vessel, with a few drops of chloroform added from time to time to prevent the development of insects. When more than one year old it is unfit for use.

The active constituents of ergot are not definitely ascertained. It contains, however, an acid soluble in water and variously termed *telosetin*, *ergotin*, and *ergotin acid*, and another, soluble in alkalies, known as *phenolic acid*. Both of these acids possess echin properties. Robert isolated a principle known as *sermatine* 30 per cent. of a yellow non drying saponifiable fixed oil, besides pectic ls, sugar, tannin, and ash are also present. The commercial ergotin is merely a purified aqueous extract of ergot.

Jaeschke has more recently isolated two bodies: one, *phenolacetone*, which produces gangrenous effects, and *ergoserin*, which acts somewhat like Robert's *sermatine*.

Dose.—5-60 grains (0.30-4.0 Gm. [$\frac{1}{2}$ grains-2 Gm.], U. S. P.).

Official Preparations.

Extractum Ergotæ—**Extracti Ergotæ**—**Extract of Ergot**.—*Dose*, 2-10 grains (0.12-0.6 Gm.) [4 grains (0.25 Gm.), U. S. P.].

Flüidexträctum Ergotæ—**Flüidexträcti Ergotæ**—**Fluidextract of Ergot**.—*Dose*, 15-60 minims (1.0-4.0 Cc.) [30 minims (2 Cc.), U. S. P.].

Vinum Ergotæ—**Vini Ergotæ**—**Wine of Ergot**.—*Dose*, 1-3 fluidrachms (4.0-12.0 Cc.) [2 drachms (8.0 Cc.), U. S. P.].

Antagonists and Incompatibles.—The cardiac and motor depressants antagonize the action of ergot. Caustic alkalies and metallic salts are chemically incompatible.

Synergists.—Its action upon the circulation is aided by digitalis and belladonna; upon the nervous system by strychnine; while ustilago, hydrastine, gossypium, and the emmenagogues enhance its influence upon the uterus.

Physiological Action.—*Externally and Locally.*—Ergot has no distinctive action upon the skin, but upon mucous membranes its influence is that of an astringent, possessing hemostatic properties.

Internally.—**Digestive System.**—In large doses it is a gastro-intestinal irritant, occasioning considerable heat and dryness of the throat, accompanied by thirst and succeeded by pain in the stomach and bowels, vomiting, and occasionally purging, with violent peristalsis, although constipation is the commoner sequence.

Circulatory System.—Repeated medicinal doses increase the blood-pressure and render the pulse slower and smaller, the result principally of stimulation of the vasomotor center in the medulla, with possibly some influence upon the heart or the walls of the arterioles. Jacoby thinks that sphacelotoxin is the chief agent in causing the contraction of the arteries, and that its activities are exerted both centrally and peripherally.

The heart muscle itself seems to be stimulated secondarily only.

Nervous System.—Medicinal doses have no especial action, though excessive doses sometimes depress the sensory mechanism, producing general cutaneous anesthesia.

The action of toxic doses on the nervous system will be described under "Poisoning."

Medulla.—Ergot has a distinct action on the medulla, stimulating the respiratory and cardio-inhibitory centers, and acting as a distinct stimulant to the vasoconstrictor apparatus. Its action on circulation is thus marked.

Respiratory System.—Medicinal doses produce a mild stimulation of the respiratory center.

Absorption and Elimination.—The actual constituents of ergot are rapidly absorbed into the blood, and are eliminated principally by the kidneys, increasing the urinary flow.

Temperature.—No special action has been observed.

Eye.—The caliber of the retinal and nutrient optic blood-vessels is reduced, resulting in marked pallor of the disk, transitory amblyopia, and papillary anemia.

Uterus.—Probably the most important action of ergot is upon

this organ. It produces in full doses tetanic, tonic contraction of the uterine muscle, the uterus becoming hard and pale, and forcing the blood out of the uterine arterioles. The organ is more sensitive to the action of the drug during pregnancy.

The precise manner in which ergot affects the uterus is still a matter of discussion. It is fairly demonstrated, however, that the drug acts both centrally and peripherally.

It is doubtful if any drug in our *Materia Medica* has been more carefully studied than ergot, and, if opinions differ widely as to its *modus operandi*, it is because we have to deal with a very complex substance, the nature, and even the number, of whose constituents are as yet inadequately known. Many principles of the drug are unstable and variable in their action, certain preparations differing decidedly from others in their influence, as, for instance, Tanret's ergotinine, which has no effect upon the uterus. Bonjean's ergotin is a powerful ecbolic, and has a marked action, moreover, upon the vascular system, whereas Wigger's ergotin is inert. Kobert's cornutine is probably not a pure principle, and his ergotinic acid is not a true principle. Jacoby's principles are those last isolated.

Untoward Action.—In addition to the gastro-intestinal disturbances already described, there are occasionally produced headaches, mental confusion, dizziness, a feeling of chilliness, muscular weakness, dilatation of pupils, and glimmering before the eyes.

Poisoning.—There are two varieties of ergot-poisoning, acute and chronic. Under the administration of immoderate doses peculiar symptoms appear, known collectively as *acute ergotism*. Restlessness, mental worry, headache, tinnitus aurium, dilatation of the pupils, pallor and coldness of the skin, and other effects are present. There is a weak, slow pulse and evident symptoms of respiratory failure. At times cutaneous anesthesia is manifest, or general formication. There may be disturbances of vision and of hearing. Epileptiform spasms, great reduction of respiration and temperature may occur, while obstruction of cardiac movements, with sudden nausea, salivation, violent vomiting, and intense diarrhea, and other alarming manifestations, attest the untoward properties of the drug. In pregnant women colic, abortion, and hemorrhage may occur. Death may take place at the end of about twenty-four hours, but the dose must be enormous. Sixty grains of ergot have produced very severe symptoms. As most of the acute poisonous cases have been complicated by abortion and hemorrhage, the lethal dose is difficult to estimate. Proportions of over 2 per cent. of ergot in rye flour may cause acute intoxication.

Chronic ergotism is confined chiefly to Europe, where ergotized rye is used in bread-making. The disease is marked by convulsive or gangrenous conditions. Numerous irregular types are observed.

The first variety, the convulsive, is characterized by paroxysmal spasms of the flexor muscles, which later become continuous, resulting in opisthotonos or emprosthotonos. There is dimness of vision, while an increasing intensity of symptoms develops affections

of other special senses, those of hearing and smell being either impaired or temporarily lost. Violent abdominal cramps also occur, together with painful dyspnea, death resulting from asphyxia or coma.

The second (gangrenous) form is signalized by severity of local phenomena, profound dyscrasia, formication or cutaneous anesthesia, impairment of special senses, and numbness of the muscles or extremities, followed by sloughing or atrophy of the diseased parts and mummification, or dry or moist gangrene.

Fatal results of chronic ergotism are usually traceable to the convulsions, although moist or dry gangrene may in certain cases produce death.

A form of ergotism is described in Lombardy, Italy, occasioned by chronic poisoning with diseased or fermented maize, and affecting principally the cerebrospinal and digestive systems. It causes an acute erythema, which extends rapidly and is attended with much swelling, together with an extreme sensation of burning or itching. Pronounced nervous and general symptoms are present, and the malady not infrequently results in insanity or melancholia. Locomotor-ataxia-like symptoms are also encountered when the vessels of the cord are involved.

Treatment of Poisoning.—Symptoms of acute poisoning may be alleviated by hot baths and the administration of tannic acid and cardiac stimulants. For the treatment of chronic ergotism hygienic measures and symptomatic remedies are indicated.

Therapeutics.—*Externally and Locally.*—In the form of lozenges or diluted FLUID EXTRACT the drug has been employed in *acute pharyngitis*. The hypodermic injections of Bonjean's ERGOTIS are valuable in *nasal hypertrophies*, *prolapsus of the rectum*, *hemorrhoids*, *enlargement of the prostate gland*, *aneurism*, *varicocele*, and *varicose veins*.

Internally.—The most important medical use of ERGOT is to promote uterine contractions in labor. The preponderance of testimony among the most experienced obstetricians is in favor of its use only after the expulsion of the uterine contents. This is a rule, however, which cannot be invariably followed. While the employment of the drug is contraindicated in the *first stage* of labor, it may be safely employed during the second stage, when there is uterine inertia, provided all the parts be in a normal condition and there exists no mechanical impediment to the rapid delivery of the child. Ergot is of service also when the placenta is retained owing to inefficient and feeble uterine contractions.

No drug possesses so energetic and prompt an action as ergot in *postpartum* and *uterine hemorrhage*. It is an exceedingly efficacious remedy also in *subinvolution* and in *uterine fibroids* and *polypi*.

This remedy is also extremely useful in the treatment of *plithoric amenorrhea*, *congestive dysmenorrhea*, *menorrhagia*, *chronic metritis*, etc.

DILATATION OF THE CARDIAC CAVITIES without valvular lesion is

much improved by the administration of ergot; the remedy has also been employed with considerable success in *chronic diarrhea* and *dysentery*.

Incontinence of urine—depending either upon enlarged prostate, irritability, or a paretic or paralytic condition of the bladder—is greatly relieved by this remedy. The atonic form of *spermatorrhea* is palliated or cured by ergot.

The drug is of value also in *cerebral hyperemia* and consequent *mania*, as well as in *cerebrospinal meningitis*, *congestion of the spine*, *myelitis*, and *congestive headaches*.

Ergot has been highly recommended, notably by Dr. J. M. Da Costa, in *diabetes insipidus*, and by such authorities as Heltzmann and D'Enslow in *prurigo*, *erythema*, *urticaria*, and *acne rosacea*.

Owing to the peculiar action of ergot upon unstriated muscular fiber it is a valuable drug in various forms of *hemorrhage*.

Finally, this remedy has met with some success in the treatment of *leukorrhœa*, *galactorrhœa*, *hypostatic congestion of the lungs*, *whooping cough*, the different varieties of *purpura*, *colligative sweats*, *splenic enlargements*, and *exophthalmic goiter*. In the hands of many practitioners ergot is of great value in the treatment of *alcoholism* and *morphinism*.

Contraindications.—During the first stage of labor and in *cerebral or spinal anemia*.

Administration.—For its action upon the uterus a valuable fluidextract is the best preparation as an internal remedy; for hypodermic use of the aqueous extract (Bonjean's ergotin) or some of the non-alcoholic fluid preparations manufactured by certain reliable pharmacists for this particular purpose, should be employed. Ergotin may be incorporated in suppositories when for any reason it is desirable to administer the drug *per rectum*.

Gossypii Cōrtex—Gossypii Cōrticis—Cotton-root Bark. U. S. P.

Origin.—The dried bark of the root of *Gossypium herbaceum* L. and of other species of the genus, indigenous in the tropical and subtropical regions of Asia and Africa. The plant has been cultivated in the United States and other countries from a very early period, many characteristic varieties having been produced.

Description and Properties.—It occurs in thin, flexible bands or quilled pieces, the outer surface brownish yellow, with slight longitudinal ridges or incisions, small, black circular dots, or short, transverse lines, and dull, brownish-orange patches, from the abrasion of the thin cork; inner surface whitish, of a silky luster, finely striate; bast fibers long, tough, and separable into papery layers; inodorous; taste very slightly acid and faintly astringent.

It contains a fixed oil, a small quantity of tannin, sugar, and starch, a yellow resin, and, in the fresh bark, a pale yellow chromogen, soluble in alcohol, which on exposure to air becomes red and resinous.

Dose. 15-60 grains (1.04-4.0 Gm.) [30 grains (2 Gm.), U. S. P].

Antagonists and Incompatibles.—The same as for ergot.

Synergists.—Ergot and its synergists.

Physiological Action.—Resembling ergot somewhat, but inferior in certainty of action.

Therapeutics.—Cotton-root bark is employed only for its action upon the uterus. An exception may possibly be in its use in the treatment of *subinvolution* and *tumors of the uterus*, in which cases it is less efficient than ergot. The drug is very unreliable, many pharmacologists claiming that it has no action on the uterus whatever.

Contraindications.—The same as for ergot.

Administration.—The fluidextract only should be employed.

Glandulæ Suprarēnales Siccae—Glandulārum Suprarenālium Siccārum—Desiccated Suprarenal Glands. U. S. P.

Definition.—The cleaned, dried, and powdered suprarenal glands of the sheep or ox, freed from fat.

Description.—A light, yellowish, amorphous powder, having a slight characteristic odor, partially soluble in water. 1 part of the dried glands represents approximately 6 parts of fresh glands. Aqueous extracts of the glands rapidly deteriorate on keeping and should, therefore, be freshly prepared.

Dose.—Average dose: 4 grains (0.250 Gm. = 250 milligrammes), U. S. P.

Researches by Abel and Crawford first demonstrated the presence of an active principle. This they extracted in an impure form and termed it *epinephrine*. Takamine, by a different process, also extracted the principle and applied the name *adrenalin*.

In commerce the principle is sold under the names of adrenalin, suprarenin, suprarenalin, adnephryn, epinephrine, epirenan, hemisine, etc. Probably few of the bodies are pure.

Epinephrine is a nitrogenous body. Its structure is not definitely known, but it is thought to resemble the pyrrhol derivatives, particularly skatol.

Epinephrine itself as first isolated by Abel and Crawford is so unstable that it has not been possible to give it a satisfactory description. Its salts, sulphates, and hydrochlorides are more satisfactory. The sulphate is a hygroscopic, straw-colored residue, which tends to crystallize on standing over sulphuric acid. Agglomerated groups of small crystals form on the edge of the receptacle, and the entire residue takes on a semicrystalline appearance. *Adrenalin* is a more stable compound.

Physiological Action.—With aqueous solutions of fresh specimens of the dried gland or with solutions of the salts this drug has a marked action on mucous membranes. A few drops of the solution act as a rapid and strong astringent, whitening the mucous membrane by stimulating the contractile muscles of the blood-vessels. This action is local, and is manifest in the mucous membranes of the conjunctivæ, nares, pharynx, membrana tympani, vagina, urethra, and rectum. The parts to which it is applied are rendered practically bloodless. This action persists for from fifteen minutes to half an hour following a single application. Partial anesthesia may occur. Repeated applications do not seem to cause

paralysis of the blood-vessel, but often following the application an extreme secondary dilatation may occur.

When administered by the mouth, some of the systemic effects of the drug may be developed, but it is by subcutaneous injection or intravenous infusion that the systemic effects are best brought out. In general, these resemble those produced by the glucosides of the digitalis group. The heart action is rendered more forcible by direct muscular stimulation; the rate is decreased by stimulation of the vagus centers; and there is a very rapid and extreme rise in the blood-pressure, due to at least three elements—the strengthening of the heart's contractions, marked general direct contraction of the muscular fibers, and a stimulation of the vasomotor centers.

It has been observed that the pulmonary and cerebral vessels, and to a slight extent the vessels of the muscles, are less influenced than are the other vessels of the body. The retinal vessels have been observed to be dilated. The vessels of the abdominal organs are most influenced.

The most potent factor in this constriction of blood-vessels is probably the direct irritant action of the drug on smooth muscle fibers, for throughout the body this tissue is decidedly stimulated. The pupil dilates, the intestines are stimulated to greater peristaltic activity, and the uterus contracts.

In fact it has been demonstrated that as weak a solution as 1 : 20,000,000 of adrenalin in water will cause the uterus of a gravid rabbit to contract with great vigor.¹ Adrenalin may cause abortion in rabbits if injected into the body of the uterus.

The secretions, particularly of the saliva, tears, and bile, are stimulated, and adrenalin, by injection or by painting on the pancreas, exerts a distinct action on the pancreatic function, causing glycosuria (Herter). The cause of adrenalin glycosuria is not yet positively known.

Therapy.—This is still in its infancy.

The suprarenal extract should be freshly prepared, its active principle being weakened by heat and preservation. It is the most powerful astringent known, a single drop of a 1 per cent. solution instilled into the eye resulting in a whitening of the conjunctiva and lids in from two seconds to forty minutes. It is useful in all forms of inflammation of the eye, whether traumatic, infectious, or proceeding from constitutional diseases, such as rheumatism, syphilis, or tuberculosis. The pupil is not contracted by it, and tolerance is not established by its use. It possesses neither antiseptic nor anesthetic properties, the rapid cures attending its employment being entirely due to its blood-constricting influence.

In suppurative otitis and dry catarrh the extract is often valuable in relieving congestion. By it tinnitus is permanently relieved. It lessens the congestion of turbinated bodies immediately, often benefiting catarrhal affections when cocaine and other astringents fail. It reduces the congestion of an inflamed eye sufficiently to

¹ Kundnowsky, "On Isolated Uterus of Pregnant Rabbits," *Arch. f. Gyn.*, 1890, No. 2.

permit cocaine anesthesia. It has been found efficacious in relieving various strictures, as of the nasal duct, the urethra, and the esophagus.

Velich found that the extract occasions local anemia when applied to the skin, not only where there is a lesion, but also where the cuticle is unbroken. It has been used to whiten an eczematous patch and to prevent vesiculation. Dr. Douglas Stanley found that in one case of pernicious anemia the freshly prepared aqueous extract produced a marked increase in the number of red corpuscles. It is valuable in Addison's disease (Osler), and is a tonic to the heart-muscles (Oliver and Schäfer), "the tension being enormously increased by intravenous injections," though its action is less marked in subcutaneous use, and is uncertain when administered *per os*. It is much more rapid and distinct in its vessel-constricting action than either digitalis or ergot, but also very evanescent.

Its field of usefulness as a local astringent has not yet been fully explored. In nasal operations it renders the field of operation bloodless, and there is no reason why it cannot be used, when rendered aseptic, in abdominal or brain surgery, especially where continuous oozing is a bar to good technique.

The field for its systemic use will probably widen. It is a powerful heart tonic, and is particularly to be recommended in poisoning by those drugs that cause vasomotor paralysis, notably chloroform and chloral, and in threatened heart failure its use is to be commended. Addison's disease, confessedly related to the suprarenal gland in some obscure manner, may in time be benefited by its use, but as yet no markedly encouraging progress has been made in this direction.

It has been of service in some cases of gastric hemorrhage, and may be tried in typhoid, but it is doubtful whether its secondary action may not prove harmful in this connection.

The general toxicity of adrenalin seems more marked in men than in some animals, suggesting a special sensitiveness to it on the part of the human organism.

Owing to the vascular lesions which are produced by the intravenous and intratracheal injections, and for other reasons, these methods should be rejected from practice. As regards hypodermic injections, however, authorities seem to be in accord that they are not followed by vascular alterations. Nevertheless, taking into consideration the very great sensibility to adrenalin exhibited by the human subject, it is advisable not to continue the administration of the drug over a long period, no matter by what route it is introduced. In fact, it is not considered prudent to give adrenalin for more than ten days at a time at the outside limit. In the author's opinion the dose as given is too large. A dose of one-half to one milligramme in the twenty-four hours is sufficient.

There are certain distinct contraindications: (1) when the arterial tension is already elevated, (2) when the cerebral arteries are brittle or degenerate, and (3) when there is an arterial aneurism.

XANTHINE DERIVATIVES.

Caffēina—Caffēinæ—Caffeine. U. S. P.

Origin.—A feebly basic substance [$C_8H_{10}CH_2N_4O_2 + H_2O$], obtained from the dried leaves of *Thea sinensis* (tea L.), or from the dried seeds of *Coffea Arabica* (coffee) L., and found also in other plants.

It may also be prepared synthetically from theobromine by the introduction of a third methyl group.

Description and Properties.—Fleecy masses of long, flexible, white crystals, having a silky luster, without odor and of a bitter taste; permanent in the air, soluble in 80 parts of water and 33 parts of alcohol.

Dose.—2-5 grains (0.12-0.3 Gm.); [1 grain (0.065 Gm.), U. S. P.].

Official Preparations.

Caffēina Citrāta—Caffēina Citrātæ—Caffeine Citrate.—*Description and Properties.*—A white powder, odorless, having a purely acid taste and an acid reaction. One part of citrated caffeine forms a clear, syrupy solution with about 3 parts of water.

Dose.—2-5 grains (0.12-0.3 Gm.); [2 grains (0.125 Gm.), U. S. P.].

Caffēina Citrāta Effervescens—Caffēinæ Citrātæ Effervescētis—Effervescent Citrated Caffeine. **Dose,** 1-4 drachms (4.0-16.0 Gm.) [60 grains (4 Gm.), U. S. P.].

Antagonists and Incompatibles.—Cerebral and cardiac depressants antagonize the action of caffeine.

Synergists.—Members of this group and the cerebral and motor excitants. The action of caffeine upon the digestive tract may be enhanced by the vegetable bitters.

Physiological Action.—*Externally and Locally.*—Caffeine possesses no very important local action, though freshly roasted coffee is slightly analgesic and deodorant—a property due to the empyreumatic oils developed by roasting rather than to the caffeine which it contains.

Internally—Digestive System.—In moderate amounts caffeine, like tea and coffee, stimulates the appetite, improving the digestion, and relieving the sense of plenitude in the stomach. All of them increase peristalsis and (particularly coffee) act as mild laxatives and slightly stimulate the secretion of bile.

Immoderate and continued dosage of caffeine or the excessive use of tea and coffee profoundly disturbs the digestive function, resulting in gastric catarrh, indigestion, hepatic congestion, constipation, and hemorrhoids. Tea, by reason of the high percentage of tannin contained, frequently causes constipation.

Circulatory System.—Medicinal doses of caffeine strengthen and quicken the heart's action. The rapidity of the heart's action is increased, shortening the diastolic period, the drug in this respect differing from digitalis; at the same time the arterial pressure is elevated.

The precise *modus operandi* of caffeine in its action upon the circulatory system is still a disputed question, some investigators claiming that its whole and only influence proceeds from a direct stimulation of the heart-muscle, while others consider its action to be upon the nervous system. In a sense both are true. There are

direct muscle stimulation and vagus inhibition. In some instances the heart is rapid by a preponderance of the one, in other cases, slowed by the greater action of the second. Blood-pressure increase is due to both central and peripheral causes, the heart-muscle being stimulated and the arterioles contracted.

Nervous System.—The drug is a decided cerebral excitant, stimulating the mental function, occasioning wakefulness, and under large doses producing hallucinations and delirium.

Caffeine renders the reasoning and imaginative powers more acute, enabling the person to perform increased and prolonged mental work. Rarely, the ability to take in ideas is increased, and there is a heightened power of association of ideas.

On the medulla caffeine is a stimulant. The spinal cord reflexes are also rendered more responsive. Muscular endurance is increased by moderate amounts; large doses, on the other hand, occasion muscular trembling and weakness. In moderate amounts coffee possesses some aphrodisiac action. Excessive doses lessen the activity of the spinal reflex centers.

Respiration is both quickened and strengthened. It is one of the most reliable and least toxic of the direct respiratory stimulants.

Kidneys—Caffeine and all of the xanthines are marked diuretics. They cause an increase in the fluids, both by reason of increased filtering by heightened tension in the glomeruli, and they are also direct kidney epithelium stimulants. At times caffeine diminishes urinary secretion by a strong vasomotor action. Theobromine (monomethyl xanthine) is a better diuretic. Both the liquid and solid parts are increased.

Temperature.—Under large doses of the drug the temperature is slightly elevated, the result of combined increase of heat-production and heat-dissipation. Toxic doses first raise, and then depress, temperature.

Eye.—Strong solutions of caffeine applied to the cornea act as a mild mydriatic and anesthetic. Hutchinson records a case of amblyopia produced by the drug.

Absorption and Elimination—Caffeine is freely absorbed, and is readily broken down in the body—first, into lower methylated xanthines and then into urea.

Ordinarily caffeine lessens tissue-waste; the elimination of urea, however, is not uniform, being in some cases increased and in others diminished.

Untoward Action.—Caffeine occasionally causes marked cerebral congestion, insomnia, and embarrassment of respiration, while the untoward effects of an immoderate use of coffee are described by Guilliot (*Nat. Disp.*, p. 363) as follows:

"The skin is pale or dusky, the expression is dull, and the features have the look of premature old age, and sometimes are slightly swollen. The flesh wastes, the eyes have a glassy look, the pupils are dilated, the lips and tongue are tremulous; the appetite is lost; there is insomnia or else disturbed sleep, dyspep-

sia accompanies constipation or diarrhea; neuralgia affects the stomach and other parts; headache and vertigo are common, and spasms or general convulsions may occur." According to the same writer, "habitual excess of coffee induces in men sexual apathy and impotence, and in women leucorrhea. Sometimes it produces *pruritus ani aut vulvæ*."

Poisoning.—A case has been reported by Liell where 18 grains (1.16 Gm.) of citrated caffeine taken by a woman were in an hour and a half accompanied by the following symptoms:

"Delirium, semi-consciousness, absence of headache, pulse 55 and irregular, cold extremities and general clammy perspiration, normal temperature (?), anesthesia, slight paresis of hands, feet, and tongue, and a reeling gait. Convulsions followed of a tetanoid character, the pupils were normal, the vision dim; some vomiting took place; there was abdominal colic, but no opening of the bowels; and urination was frequent and copious."

Treatment of Poisoning.—This should include the use of emetics and eliminants, together with diffusible stimulants and the application of external heat.

Therapeutics.—*Externally and Locally*.—Burning COFFEE in a room deodorizes the air.

Internally.—The chief value of CAFFEINE is as a diuretic and cardiac stimulant, being peculiarly useful in cases of *semle cardiopathies associated with nephritis*, in which, from degeneration of the heart-muscle, digitalis is not well tolerated.

In some instances the primary effect of caffeine is to increase the pulse-rate; usually, however, if the remedy be adapted to the case, there is a secondary slowing of the heart's action. The drug is considered by some physicians to be superior to digitalis as a cardiac stimulant in valvular disease accompanied by *fatty heart*. It is an efficient remedy to counteract the *cardiac depression in low fevers*, and is a comparatively safe drug in *myocarditis*.

It is a remarkably efficacious remedy in *cardiac and renal dropsy* and to remove *pleuritic effusion*, etc.

Caffeine cannot displace digitalis as a heart tonic, but as diuretics the xanthin derivatives, caffeine and theobromine, are excellent. Theobromine is the better diuretic of the two. They both act as stimulants to the kidney epithelium, and contrasted with the saline diuretics, which increase the elimination of inorganic salts, the xanthine derivatives aid in the elimination of nitrogenous substances, notably urea and uric acid.

Its action upon the digestive system renders caffeine of great value as a stomachic tonic. *Migraine*, due either to gastric catarrh or nervousness, frequently yields to this drug.

Its value in the treatment of *headaches* may be enhanced by administering it together with antipyrine or sodium bromide.

Choleric diarrhea, the result of nervous depression, is often markedly benefited by CITRATED CAFFEINE. It has also been used with some success in the *diarrhea of phthisis*.

SODIUM BENZOATE OF CAFFEINE in doses of 5 to 10 grains (0.32–0.64 Gm) is considered by Mistrachi to be superior to ergot in *postpartum hemorrhage*. **CAFFEINE** possesses a considerable reputation as a remedy for *asthma*. Caffeine is invaluable in the treatment of shock, and in all poisoning associated with low blood-pressure and respiratory depression. It is a valuable stimulant in *acute adynamia*, particularly in *typhoid fever*.

It is a matter of frequent observation that strong **COFFEE** certainly modifies the effects of *alcoholic intoxication*. *Hiccough* is often relieved by coffee.

CAFFEINE or strong **COFFEE** has unquestionably proved valuable in the reduction of *strangulated hernias* after taxis has failed.

The medical uses of **CAFFEINE** would be incomplete without mention of its extreme value in *opium-poisoning*. Here a salt of caffeine may be used hypodermically or a strong infusion of **COFFEE** given by the mouth or rectum.

Contraindications.—Ordinarily, caffeine is contraindicated in acute inflammations, particularly of the kidney.

Administration.—The alkaloid may be given by the stomach, but when hypodermic medication is desired caffeine is unavailable, a fresh salt for hypodermic use being properly employed, made by combining caffeine with salicylic acid, cinnamic acid, or sodium benzoate. The latter salt—sodio-benzoate of caffeine—is probably the most eligible and contains 45 per cent of caffeine.

The citrated caffeine should be given in pills, capsules, or tablets, the effervescent citrate, in water.

A valerianate of caffeine is prepared which has been employed with success, it is asserted, in *hysterical vomiting* and *whooping cough* in doses of from $\frac{1}{2}$ to 2 grains (0.03–0.12 Gm).

Strong coffee serves as a most excellent substitute for the alkaloid, and may be given by the mouth or as an enema.

Meat Extracts.—These contain high percentages of xanthin or purin bases, creatin, creatinin, etc., in addition to mineral salts. It was at first assumed, by the manufacturer at least, that these beef extracts represented the concentrated essence of beef, and as such they were valuable food-products. Such, however, is not the case, and this class of bodies is best classed with the xanthin stimulants. Their action is on the heart and blood vessels and they are active diuretics. They are not foods in any sense.

DRUGS ACTING CHIEFLY TO INHIBIT CARDIAC ACTIVITY AND TO CAUSE VASODILATATION.

Aconitum—Aconiti—Aconite. U. S. P.

Origin.—The dried tubertous root of *Aconitum Napellus* L., collected in autumn, and drying when assayed not less than 0.5 per cent of aconitine, a plant about 40 inches (1 M) high, met with throughout the greater portion of Asia and Europe, mostly in mountainous regions.

Other species of *Aconitum* contain a *aconitine*. Thus the Himalayan plant *A. montanum*

sericea contains it, and a closely related alkaloid, *peruviolonitine*, while the *Aconitum japonicum* contains *japoniconitine*. Aconitine is chemically an acetyl benzoamine.

Description and Properties.—From $\frac{1}{8}$ to $\frac{1}{2}$ inch (10-20 Mm.) thick at the crown, and from 2 to 3 inches (50-75 Mm.) long, with scars or fragments of radicals, dark brown externally, whitish internally; with a rather thick bark, the central axis about seven-rayed, without odor, taste at first sweetish, soon becoming acid, and producing a sensation of tingling and numbness lasting for some time. It contains an acid alkaloid, *aconitine*.

Dose.— $\frac{1}{2}$ -2 grains (0.03-0.12 Gm.) (1 grain (0.65 Gm.) U. S. P.)

Official Preparations.

Flüidextractum Aconiti—Flüidextracti Aconiti—Fluidextract of Aconite.
—*Dose.* $\frac{1}{2}$ -2 minims (0.006-0.12 Cc.) (1 minim 0.05 Cc.) (U. S. P.)

Tinctūra Aconiti—Tincturæ Aconiti—Tincture of Aconite (10 per cent.).—
Dose. 1-15 minims (0.015-1 Cc.) (10 minims 0.6 Cc.) (U. S. P.)

Aconitina—Aconitinæ—Aconitine. U. S. P.

Definition.—An alkaloid obtained from Aconite

Description and Properties. Colorless or white rhombic tables or prisms, odorless, permanent in the air, and producing in extremely diluted solutions a characteristic tingling sensation when brought in contact with the mucous membrane of the tongue or lips. The alkaloid itself should never be tasted, and its solution only when largely diluted, and then with the utmost caution. The chemical structure of aconitine is analogous to that of atropine and cocaine.

Very slightly soluble in water (1 : 3200), much more so in alcohol (1 : 22)

Aconitine was formerly in the U. S. Pharmacopœia, but was dropped in 1880, owing to the variable composition of the article then on the market. At present there are on the market, in addition to the crystalline aconitine, an amorphous aconitine and an eclectic "aconitin." The greatest caution should be observed not to confuse these preparations, as they differ considerably in composition.

Aconitine is the most powerful drug in the Pharmacopœia; death is reported to have resulted from 0.5 milligramme ($\frac{1}{2}$ grain).

Dose.—Average dose. 0.0005 Gm. = 0.15 milligramme ($\frac{1}{4}$ grain) (U. S. P.).

Unofficial Preparation.

Oleātum Aconitinæ—Oleāti Aconitinæ—Oleate of Aconite.—A 2 per cent. solution of Aconitine in Oleic Acid. For external use. (N. F.)

Antagonists and Incompatibles.—*Digitalis* and other cardiac stimulants, including atropine and ether, antagonize the action of aconite.

Synergists.—All members of the group and cold enhance the action of the drug.

Physiological Action.—*Externally and Locally.*—Applied to mucous membranes or to the skin for any length of time, aconite first stimulates and then depresses the ends of the sensory nerves, producing respectively tingling, numbness, and local anesthesia.

Internally.—Digestive System.—Except when given in very dilute solutions, aconite produces tingling and numbness of the lips and mouth, with increased secretion from the salivary glands. Large doses cause great irritation, together with a sense of constriction in the fauces. Anesthesia to taste is also produced.

Under normal conditions of the stomach aconite may act upon that organ as a sedative, augmenting its secretions. Large doses may occasion pain, nausea, and vomiting.

Circulatory System.—Aconite causes a marked slowing of the heart's action, due to stimulation of the vagus center in the medulla. Following the slowing of the heart, due to vagus action, aconite has a direct action on the heart-muscle, increasing its irritability, causing it to become very rapid and weak, eventually occasioning delirium cordis through overstimulation. Death may occur from cardiac paralysis, the heart being arrested in diastole. The arterioles are at first contracted, owing to stimulation of the vasomotor center in the medulla, but a marked diminution in the force of the ventricular systole brings about a great decrease of blood-pressure. In poisoning there are vessel dilatation and great loss of blood-pressure.

Nervous System.—Moderate or even large doses have little or no effect on the cerebral centers. The main action of aconite in the nervous system is on the medulla. Here there is stimulation followed by depression. Excessive doses of aconite cause a slight stimulation of the sensory nerve-endings, finally followed by depression, the muscles passing into a state of paralysis, probably occasioned by direct action upon the muscle-tissue.

Respiratory System.—The respiration is slowed by moderate doses; under large doses it is rendered both shallow and slow. The breathing is retarded, because the peripheral endings of the vagi distributed to the lungs are depressed. Under large doses there is depression of the respiratory center, paralysis of which is occasioned by lethal amounts.

Temperature.—Aconite is alleged to be a decided antipyretic, the reduction of temperature being due to various causes: (1) The slowing of the circulation, diminishing the metabolism, (2) the peripheral action of aconite, causing dilatation of the cutaneous blood-vessels; (3) the depressing action of the drug upon all muscle-tissue.

Eye.—Toxic amounts of the drug have produced mydriasis, misty vision, and diplopia.

Absorption and Elimination.—Aconite is rapidly absorbed, but its channels of elimination are not definitely known, although it is probably excreted by the kidneys, and to some extent by the skin, the drug acting as a mild diaphoretic.

Untoward Action.—Besides the symptoms described under "Poisoning," there have been observed pustular and erythematous eruptions, vertigo, and dimness of vision.

Poisoning.—The first effect of toxic doses is to cause marked tingling of the tongue and lips, which sensation soon extends to the fingers and may even affect the entire cutaneous surface. There is extreme muscular weakness, particularly noticeable in the lower extremities. Salivation, excessive cold clammy perspiration, nausea, vomiting, diarrhea, and pain in the stomach occur. The pulse, at first slow and weak (down to 40), soon becomes rapid and almost imperceptible. The respirations are quite feeble and shallow, being at times reduced to 10-12 to the minute, and there may be marked dyspnea.

The countenance is anxious and the skin pallid, cold, and covered with sweat, with great reduction of temperature. These symptoms are accompanied by dimness of vision, the pupils usually being widely dilated. Rarely there are present epileptiform convulsions.

Death may be postponed for some time, or it may rapidly follow a lethal dose. The minimum lethal dose of aconitine for adults is $\frac{1}{8}$ grain (0.003 Gm.).

Treatment of Poisoning.—The patient should be placed in a horizontal position, better with the feet raised slightly. The stomach should be thoroughly evacuated; bodily heat should be maintained by external warmth; diffusible stimulants, such as ether, alcohol, and spirits of ammonia should be given. Caffeine is useful, but artificial respiration is of the greatest service.

Therapeutics.—*Externally and Locally.*—Whether locally applied or given internally ACONITE is an excellent remedy in *neuralgias*, particularly in *tic douloureux*. The TINCTURE, ACONITE LINIMENT, or an OINTMENT OF ACONITINE may be applied to the course of the affected nerve. The TINCTURE OF ACONITE frequently proves beneficial in *herpes zoster*, *chilblain*, *pruritus*, etc., and its extended application has even been recommended to allay the pain of *chronic rheumatism*.

Internally.—ACONITE is an exceedingly efficacious remedy in many febrile diseases, particularly the *sthenic fevers* of children and those fevers resulting from inflammation, such as *tonsillitis*, *laryngitis*, *pharyngitis*, *quinsy*, etc. The drug seems to exert a peculiarly beneficial influence on mucous membranes, all acute inflammatory conditions of the throat, bronchial tubes, or intestinal canal—characterized by fever, a small, wiry pulse, and rapid cardiac action—being greatly improved by the remedy. Digitalin may be advantageously added to aconitine in these cases to steady the heart, veratrine to increase elimination, and strychnine arsenate to increase vitality.

As previously indicated, aconite is one of the most efficient sedatives in the *irritative fevers of children*. It is equally valuable in the *first stage of pneumonia* and in *pleurisy*, and is an invaluable adjunct to opium in the treatment of *peritonitis*.

Pericardium is often favorably influenced by this drug, while it is also of great service in allaying *nervous palpitation* of the heart or that due to *excessive cardiac hypertrophy*.

The injection into the rectum of 8 or 10 minims (0.5–0.6 Cc.) of the TINCTURE OF ACONITE, while perhaps producing a slight prolapsus of the rectum, quickly affects an *irritable stricture of the urethra*, so that a catheter may be passed with little difficulty, although the operation may have been previously found impossible.

Probably there is no better combination to “break up a cold” than aconite and Dover’s powder, the TINCTURE OF ACONITE, given at frequent intervals for a few hours, being followed, preferably at bedtime, with 8 or 10 grains (0.5–0.6 Gm.) of Dover’s powder.

In sudden congestions from exposure to cold and wet, with consequent chills, headache, stoppage of menstruation, etc., the prompt use of aconite will generally restore the circulatory equilibrium and bring back the flow, averting a serious illness.

ACONITE has been favorably recommended in the acute stages of *cerebrospinal meningitis* and as a cardiac sedative in *aneurism*.

Contraindications.—Aconite is always contraindicated in sub-acute or chronic conditions, or when the heart's action is weak. It is also intolerable in catarrhal conditions of the stomach.

Administration.—A good, reliable tincture is the best preparation for internal use. Moreover, better results are obtained by giving the drug in fraction of minim doses—from $\frac{1}{16}$ to $\frac{1}{4}$ minim (0.006–0.03 Cc) in a teaspoonful of water every fifteen minutes—than by larger dosage. The most desirable influence of the drug appears to be realized by this method.

Verātrum—Verātri—Veratrum. U. S. P.

(AMERICAN HELLEBORE.)

Origin.—The dried rhizome and roots of *Veratrum viride* Solander, a plant growing in swampy places and damp thickets in Canada, and in the United States as far south as Georgia. The plant closely resembles *V. album* of Europe, and is also allied to a species found in Eastern Siberia.

Description and Properties.—Rhizome upright, obconical, simple or divided, from 2 to 3 inches (50–75 Mm.) long, externally blackish gray, internally grayish white, showing numerous short, irregular wood bundles. Many shrivelled, light yellowish-brown roots issue from all parts of the rhizome.

The drug is inodorous, but strongly sternutatory when powdered, the taste bitterish and very acrid.

Veratrum viride contains the following alkaloids: *veratrine*, *pseudoveratrine*, *rubijervine*, and *cevadine*. The veratrine is in small amounts only. The closely related *Anagallis officinalis* or *Sabadilla* contains veratrine in larger amounts; it also contains a related alkaloid protoveratrine.

Dose.— $\frac{1}{2}$ grains (0.01–0.3 Gm.) [2 grains (0.125 Gm.), U. S. P.].

Official Preparations.

Flüidextrāctum Verātri—Flüidextrāctum Verātri—Fluidextract of Veratrum.—*See*, $\frac{1}{4}$ –5 minims (0.01–0.3 Cc.) [1½ minims (0.3 Cc.), U. S. P.]

Tinctūra Verātri—Tinctūra Verātri—Tincture of Veratrum (10 per cent.).—*Dose*, 1–15 minims (0.06–1 Cc.) [15 minims (1 Cc.), U. S. P.].

Allied Drugs.

Verātrum Albū—Verātri Ālbi—White or European Hellebore.

Sebadilla—Sebadilla—Cevadilla.

The seeds of this plant yield the following official alkaloid, known as Veratrine:

Veratrina—Veratrinæ—Veratrine. U. S. P.

Definition.—A mixture of alkaloids obtained from the seed of *Anagallis officinalis* (Charta and Seebach) Lundl.

Description and Properties.—A white or grayish-white, amorphous or semicrystalline powder, odorless, but causing intense irritation and sneezing when ever even a minute quantity reaches the mucous membrane, of an acrid taste, and leaving a sensation of tingling and numbness on the tongue; permanent in the air, very slightly soluble in hot or cold water, soluble in 3 parts of alcohol.

Dose.— $\frac{1}{16}$ – $\frac{1}{4}$ grain (0.0016–0.016 Gm.) [$\frac{1}{16}$ grain (0.002 Gm.), U. S. P.].

Official Preparations.

Oleatum Veratrinae—**Oleati Veratrinae**—Oleate of Veratrine (2 per cent.).
For external use.

Unguentum Veratrinae—**Unguēti Veratrinae**—Veratrine Ointment (4 per cent.). For external use.

Antagonists, Incompatibles, and Synergists are the same as for Aconite.

Physiological Action.—*Externally and Locally.*—Veratrum is more of an irritant than aconite, exciting some inflammation of the skin when applied locally, and when in contact with the nasal mucous membrane producing violent sneezing.

Internally.—Its effects are in every respect analogous to those of aconite, with the following exceptions, in the several systems:

Digestive System.—Veratrum is more apt to occasion nausea and vomiting.

Circulatory System.—The drug is a more powerful depressant to the circulation, small doses, while not materially affecting the pulse-rate, greatly reducing its force, large doses rendering the pulse very weak, almost indistinguishable, and very rapid.

Nervous System.—It causes, as does aconite, analgesia, and in large doses also paralyzes the muscles in an unknown manner. Under moderate doses there is extreme muscular weakness. Veratrine causes this loss of muscular power, while pseudoveratrine does not.

Respiratory System.—Veratrum depresses the respiration less than aconite.

Absorption and Elimination.—The drug is absorbed with great facility, and is eliminated chiefly by the bowels. It possesses much feebleness diuretic and diaphoretic properties than aconite.

Temperature.—In medicinal doses it is not so powerful an antipyretic as aconite.

Untoward Action.—Veratrum occasionally produces an erythematous or pustular eruption.

Poisoning.—Except that the drug may cause less anesthesia, the symptoms of poisoning are almost identical with those occasioned by aconite.

Treatment of Poisoning.—The same as prescribed for aconite.

Therapeutics.—*Externally and Locally.*—**VERATRUM VIRIDE** is seldom, if ever, used locally. **VERATRINE**, though in rare cases given internally, is well-nigh restricted to external or local application.

The **OLEATE** or **ointment** of **VERATRINE** when applied over the affected nerve is exceedingly efficacious in *neuralgia*, particularly in the *douloureux* and *orbital neuralgia*. In the latter affection great care should be taken in administration, lest some portion of the drug enter the eye, in which case violent and persistent conjunctivitis would ensue.

Internally.—**VERATRUM VIRIDE** may be employed for the same conditions for which aconite is recommended, although it is doubt-

ful whether it possesses any advantages over the latter drug; indeed, by many competent physicians it is considered inferior to, and more dangerous than, aconite. Moreover, the nausea and vomiting which in many patients are likely to follow the ingestion of this drug render its use objectionable. A large number of physicians claim to have found it of value in the treatment of *puerperal eclampsia*. Here it should be given in doses sufficient to cause nausea or even vomiting.

Contraindications.—The same as for aconite.

Administration.—The tincture of *veratrum viride* only should be given, beginning with small doses, as recommended for aconite, and cautiously increasing the amount. Veratrine may be applied in the form of an ointment, oleate, or in solution together with alcohol and glycerin.

Phytolacca—Phytolaccæ—Phytolacca. U. S. P.

(POKE-ROOT.)

Definition.—The dried root of *Phytolacca decandra* L.

Description and Properties.—Large, conical, branched, and fleshy; mostly in transverse or longitudinal slices, wrinkled, grayish, hard; fracture fibrous, the wood-bundles in several distinct concentric circles; inodorous, taste sweetish and acid. It contains resin, gum, fixed oil, tannin, starch, sugar, and a glycosid. Phytolaccotoxin is an alkaloid related to picrotoxin, which is found in a Japanese species of *Phytolacca*.

Dose.—5-30 grains (0.3-2.0 Gm.).

Official Preparation.

Flüidexträctum Phytolaccæ Flüidexträcti Phytolaccæ.—Fluidextract of *Phytolacca*.—Dose, 5-30 minims (0.3-2.0 Cc.) [$\frac{1}{4}$ -15 minims (0.1-1 Cc.) as alterative or emetic respectively U. S. P.]

Physiological Action.—*Externally and Locally.*—The powdered root is extremely irritating to mucous membranes, in certain subjects occasioning an erythematous eruption and excoications.

Internally.—**Digestive System.**—*Phytolacca* possesses emetocathartic properties. It occasions much nausea, with great depression, persisting for some time before vomiting occurs. The drug augments the secretion of bile and acts as a laxative.

Circulatory System.—Like aconite, it reduces the force and frequency of the heart's action and lowers arterial tension.

Nervous System.—Poke-root is a powerful motor depressant, acting as a direct paralyzant to the spinal cord and medulla, although the muscles and motor nerves are unaffected.

Respiratory System.—*Phytolacca* is a respiratory depressant, rendering the breathing slow and shallow. Toxic doses produce death by paralysis of the respiratory center, preceded by tetanic convulsions.

Absorption and Elimination.—The drug is readily absorbed, and is eliminated chiefly by the kidneys.

Temperature.—Medicinal doses have no effect on temperature.

Poisoning.—The symptoms of poisoning are quite similar to those

produced by veratrum, though the nausea and vomiting are postponed longer after the ingestion of phytolacca.

Treatment of Poisoning.—The same as recommended under Aconite and Veratrum.

Therapeutics.—*Externally and Locally.*—Preparations of phytolacca have been successfully used to allay inflammation, as in cases of follicular pharyngitis, tonsillitis, mastitis, ulcers, buboes, burns, abscesses. The drug is also useful in chronic eczema, sycosis, favus, etc. The FLUIDEXTRACT may be applied, or the powdered root incorporated in ointment either singly or associated with other medicinal agents.

Internally.—The drug has proved of doubtful service in chronic rheumatism, its alterative properties rendering it also of some service in the treatment of scrofula, syphilis, and chronic diseases of the skin.

It has been recommended in obesity, possessing undoubted efficacy in this respect. It is claimed that the proprietary preparation known as "Anti-fat" is a resinoid preparation of the berries.

Contraindications.—The same as for veratrum viride.

Administration.—No special directions are necessary. The powder, tincture, or fluidextract may be given internally; for topical use an ointment may be prepared.

Pulsatilla—Pulsatillæ—Pulsatilla. (*Non-official.*)

Origin. The herb of *Anemone Pulsatilla* and *Anemone pratensis* L., collected soon after flowering.

Description and Properties.—Leaves radical, petiolate, silky villous, twice or thrice deeply three parted or pinnately cleft, with linear, acute lobes, appearing after the large purple flowers, inodorous, very acrid. It contains a peculiar, acrid, crystallizable principle known as *anemonin*. Other constituents not as yet isolated may also be present.

Dose.—1-5 grains (0.06-0.3 Gm.).

Physiological Action.—*Externally and Locally.*—Pulsatilla is a decided irritant to the skin, the bruised plant when rubbed upon it even producing vesication. In the mouth it produces a sensation of burning, succeeded by numbness.

Internally.—The action of the drug is similar to that of aconite, though pulsatilla possesses greater emetic properties.

Therapeutics.—The drug may be employed for the same purposes as aconite, though as a cardiac sedative it is less efficient. It has been recommended as a useful emmenagogue.

Arnica—Arnicae—Arnica. U. S. P.

Origin.—The dried flower heads of *Arnica montana* L., a plant indigenous in the mountainous regions of Europe and Northern Asia, and also found in the north western part of America.

Description and Properties.—Heads about 1 to 2 inches (25-50 Mm.) in diameter, depressed roundish, consisting of a scaly involucre in two rows, and a small, nearly flat, hairy receptacle, bearing about sixteen yellow, strap-shaped, ten-nerved ray florets and numerous yellow, five-toothed, tubular disk florets, with slender, spand-

shaped akebes crowned by a hairy pappus. Odor feeble and aromatic, taste bitter and acid.

Arnica flowers contain a glycosid (?), *arnicin*, a *volatile oil*, caproic and caprylic acids, resins, tannin, etc.

Dose.—5-30 grains (0.3-2.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Official Preparation.

Tinctura Arnicae—*Tinctura Arnicae*—Tincture of Arnica (20 per cent.).—

The root of *Arnica montana* and all its preparations official in the Pharmacopœia of 1890, have been dropped from the Pharmacopœia of 1900.

Physiological Action.—*Externally and Locally.*—The local action of both the root and flowers is irritant, that of the latter being the more powerful. Occasionally tincture of arnica flowers produces marked inflammation of the skin, resembling erysipelas.

Internally.—The internal effects of arnica are as yet imperfectly understood, it being difficult to assign the drug to its proper group.

Digestive System.—Small doses slightly stimulate the digestive apparatus. Large amounts produce nausea, vomiting, and diarrhea of a choleraic character.

Circulatory System.—Small doses stimulate the heart and increase arterial pressure; full or large doses retard the pulse and depress the circulation.

Nervous System.—Large amounts cause headache, with great depression of the nerve-centers. Toxic amounts occasion motor and sensory paralysis, coma, at times convulsions, collapse, and death.

Respiratory System.—The respiration is slowed, although under small doses there may be temporary acceleration.

Absorption and Elimination.—The active principle of arnica diffuses readily into the blood, the drug being eliminated chiefly by the kidneys, though the skin shares in the excretory process.

Temperature.—Large doses cause a reduction of temperature.

Untoward Action.—The topical application of arnica may cause in susceptible persons violent cutaneous inflammation and the production of pustules, or even distinct bullæ, attended with marked constitutional symptoms. When taken internally the drug occasions a sensation of burning in the mouth and throat, violent pain in the stomach, tenesmus, and choleraic diarrhea, intense headache, and dizziness.

Poisoning.—In addition to the above-named symptoms there are great cardiac depression, decided muscular weakness, slow and shallow respiration, paralysis of the nervous system, and death resulting from collapse.

Treatment of Poisoning.—The treatment should be much the same as that prescribed under Aconite. Atropine is probably the best physiological antidote.

Therapeutics.—*Externally and Locally.*—ARNICA enjoys a wide reputation as a remedy for the relief of bruises, sprains, and external

inflammations generally. It is highly probable that its efficiency is due in part to a slight counterirritant effect, and to the alcohol contained in the mixtures. It has been recommended also as a topical application in *myalgic rheumatism*. The local application of the TINCTURE causes the rapid disappearance of *ecchymoses*. Equal parts of TINCTURE OF ARNICA and glycerin, diluted with water, have been recommended as a stimulant in *inflammation of the mucous membrane of the mouth*.

Internally ARNICA is not a very popular remedy.

Contraindications.—*Externally* when there exists any acute skin disease; *internally* in cases of inflammation of the gastro-intestinal tract, fatty or valvular disease of the heart, and in all asthmatic conditions.

Administration.—The tincture of arnica is the form generally preferred for external and internal use. In applying any preparation externally the susceptibility to the irritating properties of the drug peculiar to certain persons should be remembered.

VASODILATORS.

One set of the circulatory drugs has the primary property of dilating the blood-vessels and of reducing the blood-pressure. This action is in large part due to a depressing action they exert on unstriated muscular fiber, particularly on the walls of the blood-vessels. These drugs are practically the exact opposites in their action to that of adrenalin and ergot. They are all nitrites, in which the NO ion is the active part of the molecule. The most important of these are amyl nitrite, nitroglycerin, sodium and potassium nitrite, erythrol tetranitrite, and mannitol hexanitrite.

In addition to their action on the blood-vessels the nitrites affect the blood. They cause the formation of methemoglobin and thus limit oxidation in the tissues.

Amylis Nitris—Amylis Nitritis—Amyl Nitrite. U. S. P.

Origin.—A liquid containing about 80 per cent. of amyl (principally iso-amyl) nitrite. Obtained by the action of nitric acid upon amyl alcohol.

Description and Properties.—A clear yellow or pale yellow liquid, of a peculiar ethereal, fruity odor and a pungent, aromatic taste. Almost insoluble in water; miscible in all proportions with alcohol or ether. In alcoholic solution it gradually decomposes, with formation of ethyl nitrite and amyl alcohol. It should be kept in small, dark colored, glass-stoppered bottles, in a cool and dark place, remote from lights and fire.

Dose.— $\frac{1}{4}$ to 1 minim (0.03–0.06 Cc.) internally; for inhalation 1–5 minims (0.06–0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.]

Physiological Action.—*Externally and Locally*—Its action is that of a mild irritant when applied to the skin.

Internally—The following actions apply to ingestion or inhalation of the drug.

Circulatory System.—Almost immediately after inhalation of amyl nitrite there is a marked flushing of the skin, first perceptible

in the face, doubtless occasioned by dilatation of the capillaries. The heart's action is increased and somewhat weakened, and the pulse is soft and compressible. The blood-pressure falls very markedly, the condition being caused by a paralyzing action upon the muscle-fibers found in the walls of the small arterioles, causing marked dilatation. The same cause accounts for the change in the action of the heart, due to diminution of peripheral resistance. Amyl nitrite has little central action.

The inhalation of large amounts renders the heart very weak, toxic doses arresting that organ in diastole.

Nervous System.—Among the effects are cerebral oppression, flushing of the head and face, vertigo, headache, and confusion of ideas, with diminished reflex excitability, muscular weakness, and unsteadiness of gait, both the voluntary and involuntary muscles being relaxed. These actions are due to the depressing influence of the drug upon the motor areas of the brain and spinal cord.

Respiratory System.—Small doses quicken the respiration by lowering arterial pressure and possibly by moderate stimulation of the center, due to accumulation of carbon dioxide. Immoderate or toxic amounts render the breathing slow and labored from depression of the respiratory center and arrest of the oxygenating function of the blood.

Absorption and Elimination.—Amyl nitrite is rapidly absorbed, being eliminated chiefly by the kidneys, increasing the amount of urine, uric acid, and urea excreted. Sugar may frequently be detected in the urine, probably resulting from the action of the drug in dilating the hepatic vessels and increasing the circulation in the liver.

Blood.—Amyl nitrite, as all the nitrites, causes fixation meth-hemoglobin to take the place of oxyhemoglobin. Nitric-oxide-hemoglobin compounds are also formed. The blood becomes dark chocolate in color and asphyxiation may result, though rarely.

Temperature.—Bodily heat is reduced both in health and in fever, due to dilatation of the peripheral blood-vessels and a reduction of the oxygen-carrying power of the red blood-corpuscles.

Eyes.—There is marked dilatation of the retinal vessels and hyperemia of the papilla, producing chromatopsia of the parti-colored variety and hallucinations of vision. These effects are usually transitory, and disappear with the elimination of the drug.

Uterus.—The uterine muscle is relaxed.

Unfavorable Action.—In addition to the symptoms described under "Poisoning," there have been noted gastric disturbance, nausea and vomiting, dryness of the mouth and trembling of the lips, irritation of the throat, defective vision, and subjective sensations of color, usually yellow vision.

Poisoning.—The toxic effects of amyl nitrite include an exceedingly rapid and weak heart, final retardation of the pulse, cyanosis of the face, slow and shallow respiration, cold extremities, subnormal temperature, great muscular weakness, abolished reflexes, vertigo, intense headache, and disordered vision. Death results

from cardiac or respiratory failure. 3.0 Gm. swallowed by mistake by a sixty-year-old man has produced alarming symptoms lasting several hours. The characteristic banana-like odor is valuable in diagnosis. Fusel oil is not distinguishable from it by odor alone.

Treatment of Poisoning.—Strychnine and digitalis are required to sustain the heart; ergotin or atropine may be administered subcutaneously, together with cold applications to the head, diffusible stimulants, and artificial respiration if necessary. Adrenalin is valuable.

Sōdii Nītris—Sōdii Nitritis—Sodium Nitrite. U. S. P.

Origin.—It should contain not less than 90 per cent. of pure sodium nitrite. Obtained by heating sodium nitrate with lead, the oxygen from the nitrate being abstracted by the lead oxide formed.

Description and Properties.—White, opaque, fused masses, usually in the form of pencils, or colorless, transparent, hexagonal crystals; odorless, and of a mild, saline taste. When exposed to the air the salt deliquesces and is gradually oxidized to sodium nitrate. Soluble in about 15 parts of water, slightly soluble in alcohol. It should be kept in well stoppered bottles.

Dose.—2-5 grains (0.12-0.3 Gm.).

Other Nitrites.

Erythrol tetranitrate and mannitol hexanitrite are organic nitrates that have similar action. This action is more prolonged, and is therefore to be recommended in chronic conditions. *Dose.* $\frac{1}{2}$ grain to 5 Gm.).

The comparison of the activity of these various nitrites is graphically represented in the following chart taken from Bradbury.

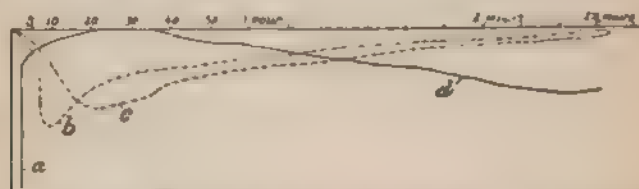


FIG. 1.—Diagram to illustrate the intensity and duration of the action of the members of the nitrite series. The extent of the fall of pressure is measured along the vertical, the duration along the horizontal line. *a*, Amyl nitrite; ethyl nitrite etc.; *b*, nitroglycerin; *c*, sodium nitrite; *d*, erythrol tetranitrate. The greatest reduction occurs in *a*, but it passes off for the most part in five minutes and entirely in twenty. Nitroglycerin acts more rapidly than the last two, and its effects continue almost as long as those of sodium nitrite. Erythrol tetranitrate only exerts its full effect after the action of the others has passed off (Bradbury).

Spiritus Glycerylis Nitrātis—Spiritus Glycerylis Nitratīs—Spirit of Glyceryl Trinitrate. U. S. P.

(SPIRIT OF NITROGLYCERIN.)

Definition.—An alcoholic solution containing 1 per cent. by weight of glyceryl trinitrate.

Origin.—Nitroglycerin is obtained by gradually adding dehydrated glycerin to a mixture of nitric and strong sulphuric acid, the nitroglycerin formed being washed with water and dilute soda solution to remove all acid.

Description and Properties.—Nitroglycerin occurs as a clear colorless liquid possessing the odor and taste of alcohol. It should be tasted and handled with great caution, since it is apt to produce violent headache, whether ingested or applied to the skin. It explodes with great force, and should be kept in a cool place, remote from lights or fire.

Dose.—1-3 minims (0.06-0.15 Cc.) of the spirit [1 minim (0.05 Cc.), U. S. P.].

The action of nitroglycerin is very similar to that of amyl nitrite, although it is less prompt, while more persistent. Nitroglycerin produces a frontal headache of much greater intensity than that caused by amyl nitrite. This is also true of sodium nitrite, though the headache it occasions is less severe than that resulting from nitroglycerin.

Nitroglycerin is preferable to amyl nitrite for internal administration.

Therapeutics.—Externally and Locally.—The nitrites are not used for external purposes.

Internally.—The property of AMYL NITRITE in suddenly lowering arterial pressure and dilating the arterioles renders it of inestimable value as a relief for the terrible precordial pain in *angina pectoris*.

Epileptic seizures may often be aborted by the instant inhalation of amyl nitrite upon the first indication of the *aura epileptica*. The drug has also been successfully employed for the relief of *asthma*, particularly the uremic form, as well as for *cardiac dyspnea* and *puerperal eclampsia*.

Like many other motor depressants, it has been used in the treatment of *tetanus* and *strychnine-poisoning*. It has proved an efficient preventive for the chill occurring in *virulent malarial fever*, and has served as a valuable antidote in *poisoning from chloroform*.

The drug is indicated in all conditions of high arterial tension, as in *chronic nephritis*, etc. It is also beneficial in *congestive dysmenorrhea*.

The SODIUM NITRITE is used for the same purposes as the amyl nitrite, though superior to it for internal administration, as in cases of abnormally high *arterial tension*.

NITROGLYCERIN is specially adapted for the treatment of *cardiopathies* occurring after middle life. It is useful in chronic nephritis with high arterial tension, and, associated with digitalis, is recommended in certain cases of pneumonia. The tendency to increase of peripheral resistance in the vessels after adult life is attained renders possible the favorable administration of doses of nitroglycerin intolerable in early life.

The drug is often of marked benefit in the *arrhythmia* of slightly enlarged and degenerated hearts with *arteriosclerosis*. It is also of considerable value in relieving the *pseudo-anginas* which are frequently a feature of vascular disease. It should be given in doses of $\frac{1}{16}$ to $\frac{1}{8}$ grain (0.00032–0.0006 Gm.) twice or four times daily.

It is fair to say, however, that recent experiments by H. P. Loomis show that high arterial pressure in man is not perceptibly affected by nitroglycerin nor its dilatation of the blood-vessels apparent. The usual dose of $\frac{1}{16}$ grain (0.0006 Gm.) is too small to produce any effect in pathologic conditions; $\frac{1}{8}$ grain (0.0015 Gm.) is a minimum dose. Even in large and repeated doses the author has never seen any ill effects. It is doubtful if the urine is increased in

quantity in chronic Bright's disease by this drug. In conditions due to arterial spasms, so called, such as angina pectoris, migraine, asthma, nitroglycerin may be of benefit in full doses, often repeated, but not in arterial sclerosis, where the arteries themselves are more or less changed.

Vaquez calls attention to the variability of the action of the drug. Its vasodilating action is totally absent in a large number of cases, even in comparatively large doses. In only exceptional cases can its action be regarded as identical with amyl nitrite.

The effects of nitroglycerin are so transitory that in order to maintain a more or less continuous effect on the circulation the drug should be given at frequent intervals. To affect arterial tension in chronic conditions erythrol tetranitrate is unquestionably the more efficacious drug.

Osler recommends the prolonged administration of nitroglycerin in *leucomotor ataxia*, affirming that it lessens the frequency of the crises and relieves the neuralgic pains.

The drug is of use in *sciatica*, and frequently relieves obstinate *hiccough*. It has been recommended for the same diseases for which amyl nitrite is used.

PREPARATIONS OF AMMONIUM.

Åqua Ammōniæ Fōrtior—Åquæ Ammōniæ Fortiōris —Stronger Ammonia Water. U. S. P.

Origin.—An aqueous solution of ammonia (NH_3 , 16.93), containing 28 per cent by weight of gaseous ammonia.

Description and Properties.—A colorless, transparent liquid, having an excessively pungent odor and a very acid and alkaline reaction. It should be kept in strong, glass-stoppered bottles.

Dose.—3-6 minims (0.15-0.3 Cc.).

Official Preparation.

Spiritus Ammōniæ—Spiritus Ammōniæ—Spirit of Ammonia.—**Origin.**—An aqueous solution of ammonia, containing 10 per cent by weight of the gas.

Description and Properties.—A colorless liquid having a strong odor of ammonia and a specific gravity of about 0.808 at 25° C. (77° F.). It should be kept in glass-stoppered bottles, in a cool place.

Dose.—10-60 minims (0.5-3.7 Cc.) [15 minims (1 Cc.), U. S. P.]

Åqua Ammōniæ—Åquæ Ammōniæ—Ammonia Water. U. S. P.

Origin.—An aqueous solution of ammonia, containing 10 per cent by weight of gaseous ammonia.

Description and Properties.—A colorless, transparent liquid, having a pungent odor, an acid, alkaline taste, and a strongly alkaline reaction. It should be kept in glass-stoppered bottles, in a cool place.

Dose.—10-20 minims (0.5-1.2 Cc.) well diluted [15 minims (1 Cc.), U. S. P.]

Official Preparations.

Linimentum Ammoniae *Linimenti Ammoniae* -Ammonia Liniment (Ammonia Water, 350; Alcohol, 50; Cotton seed Oil, 570; Oleic Acid, 30, —For external use)

Spiritus Ammoniae Aromaticus—**Spiritus Ammoniae Aromatici.** See *Ammonium carbonate*.

Ammōnii Carbōnas—Ammōnii Carbonātis— Ammonium Carbonate. U. S. P.

Definition.—It should contain not less than 97 per cent. of a mixture of acid ammonium carbonate $(\text{CO}_2 + \text{H}_2\text{O})(\text{NH}_4)_2$ and ammonium carbonate $(\text{CO} + \text{NH}_3)(\text{NH}_4)_2$, and should yield not less than 33.58 per cent. of ammonia gas.

Origin.—Prepared by subjecting to sublimation and resublimation a mixture of ammonium sulphate or chloride and calcium carbonate.

Description and Properties.—White, hard, translucent, striated masses, having a strongly ammoniacal odor without empyreuma, and a sharp, saline taste. On exposure to air the salt loses both ammonia and carbonic acid, becoming opaque, and is finally converted into friable, porous lumps or a white powder. Slowly but completely soluble in about 5 parts of water, decomposed by hot water, with the elimination of carbonic acid and ammonia.

Ammonium carbonate should be kept in well stoppered bottles, in a cool place.

Dose.—2-15 grains (0.12-1.0 Gm.) [4 grains (0.25 Gm.), U. S. P].

Official Preparation.

Spiritus Ammoniae Aromaticus *Spiritus Ammoniae Aromatici* -Aromatic Spirit of Ammonia (Ammonium Carbonate, 34; Ammonia Water, 40; Oil of Nutmeg, 1; Oil of Lemon, 10; Alcohol, 700; Oil of Lavender Flowers, 1; Water to make 1000)

Description and Properties.—A nearly colorless liquid when freshly prepared, but gradually acquiring a somewhat darker tint. It has a pungent, ammoniacal odor and taste. It should be kept in glass stoppered bottles, in a cool place.

Dose.— $\frac{1}{2}$ -2 fluidrams (1.5-7.3 Cc.) [30 minims (2 Cc.), U. S. P.]

Antagonists and Incompatibles.—The cardiac sedatives are antagonistic. The incompatibles are the vegetable and mineral acids, the earthy salts, lime water, and solutions of acidulous salts.

Synergists.—Cardiac and diffusible stimulants, antispasmodics, and capsicum internally. The local action of ammonium preparations is enhanced by cantharides and counterirritants.

Physiological Action.—*Externally and Locally.*—When solutions of ammonia are applied to the skin or mucous membranes they act as irritants, rubefacients, or vesicants according to the strength of the solution and the freedom or confinement of the vapor.

When inhaled the vapor occasions great irritation of the respiratory passages, together with a sense of suffocation and spasmodic closure of the glottis. There are also produced marked irritation of the conjunctivæ, lachrymation, and a watery secretion from the nose.

Internally.—**Digestive System.**—Small doses act like alkalis upon the gastro-intestinal tract, augmenting the flow of gastric juice when given before meals and neutralizing it when given after meals.

Excessive doses occasion violent and destructive inflammation of the mouth, esophagus, and stomach, possibly resulting in stricture of the esophagus and stenosis of the pyloric orifice.

Circulatory System.—These preparations, whether ingested or injected into the system, cause a temporary fall of arterial pressure, quickly followed by a decided increase and acceleration of the pulse, owing to nervous stimulation of the heart. Their precise action upon the blood is not known, though they certainly lessen the oxygen-carrying power of the red corpuscles and diminish the tendency to coagulation of the blood.

Nervous System.—Other than their action upon the sensory nerves when locally applied, these preparations affect the nervous system only in stimulating the motor centers of the spinal cord, excessive doses causing convulsions similar to strychnine.

Respiratory System.—They stimulate the respiratory center, greatly increasing the number of respirations.

Absorption and Elimination.—The preparations of ammonium are rapidly absorbed, being oxidized in the system and eliminated chiefly by the kidneys, increasing the acidity of the urine and augmenting its amount, as well as increasing the proportion of nitric acid, uric acid, and urea excreted. The continued use of ammonium preparations therefore promotes tissue-waste.

Temperature is unaffected by medicinal amounts.

Poisoning.—In toxic doses these preparations are powerful corrosive poisons, exciting violent inflammation of the gastro-intestinal tract, labored respiration, great cardiac depression, muscular weakness, and possibly convulsions.

Treatment of Poisoning.—Similar to that of poisoning by the corrosive alkalies—evacuation of the stomach, the internal administration of vinegar or other vegetable acids, followed by oil and demulcent drinks, opium being indicated for the relief of pain.

Therapeutics.—AQUA AMMONIÆ is a valuable ingredient of "hair tonics" in *premature alopecia*. The AMMONIA LINIMENT is a favorite remedy for *chilblains*.

The AROMATIC SPIRIT OF AMMONIA is of value in many diseases of the scalp, such as *pityriasis*, etc., and, when well diluted with water, has been recommended in *acute pharyngitis*. The AMMONIUM CARBONATE possesses an action similar to that of salicylic acid in its property of dissolving epidermic scales, rendering it of value in preparing the skin for the subsequent local treatment of *psoriasis*.

As a counterirritant AMMONIA WATER—or, preferably, the AMMONIUM LINIMENT—is efficient in *chronic rheumatism* and *joint-affections*.

AMMONIA WATER relieves the irritation caused by *bites of insects*; its vapor inhaled acts as a rapid restorative in cases of *fainting*.

Internally.—The ammonium preparations here mentioned are serviceable in lessening excessive acidity of the stomach. The AROMATIC SPIRIT OF AMMONIA is frequently beneficial in allaying

the distress of *nervous headache*, and is also an efficient remedy to counteract the *effects of an immoderate use of alcoholic stimulants*, in many cases having proved valuable in the treatment of *delirium tremens*.

The most important uses of these preparations are, perhaps, as powerful diffusible stimulants to the circulatory, respiratory, and spinal systems. They are of undoubted value in sudden *cardiac failure* arising from any cause, such as *poisoning from chloroform, noxious gases, hydrocyanic acid*, etc. Taken internally or by intravenous injection, they counteract the poisonous effects resulting from the *bites of venomous reptiles*.

The CARBONATE is an excellent stimulant to sustain the heart and respiration during the course of *pneumonia, eruptive and continued fevers*, etc. In all dynamic conditions of the heart this preparation should be given in small doses, frequently repeated.

The carbonate is also a valuable stimulant expectorant in *chronic bronchitis and bronchopneumonia*.

The preparations of ammonia have been recommended in *threatened thrombosis*. The condition being established, however, it should be noted that the method of treatment by intravenous injection, advocated by some authorities, is at best a very dubious procedure.

Contraindications.—Acute gastritis and conditions of excessive acidity of the urine. Conditions of anemia and great emaciation would contraindicate the prolonged use of these preparations.

Administration.—The liquid preparations should always be well diluted, and the carbonate should invariably be given in solution. The fluidextract of glycyrrhiza disguises the taste very well.

Owing to the rapid elimination of these drugs, the dosage should be frequently repeated.

DRUGS ACTING LOCALLY ON MICRO-ORGANISMS (ANTISEPTICS).

MANY substances that act upon the protoplasm of living cells, either physically or chemically exert either a restrictive action on micro-organisms or are capable, according to the grade of concentration, of killing the micro-organisms themselves or their spores. These substances may be roughly classed as antiseptics. Germicides is a broader term. Bactericides are agents capable of killing bacteria or their spores; zoöcides are similar agents capable of killing minute animal parasites in the body of man or lower animals.

Great differences are found in the action of these substances whether the micro-organisms are spore-bearing or not. Thus, many bacteria are killed by a .1 per cent. solution of corrosive sublimate in a few minutes; while it requires an hour or even longer to kill the spores of other bacteria by this same bactericide. The spores of the anthrax bacillus can resist the action of 5 per cent. solutions of carbohc acid for several days. Analogous facts are known with reference to the animal parasites of malaria. Thus, quinine kills the free forms of the malarial parasites, while the encysted spore-bearing forms are killed with considerable difficulty.

General rules with reference to the germicidal action of various agents then are very difficult of application. Each organism is a law unto itself and should be so considered.

The germicides may be readily grouped into a few classes, and a chemical classification seems the most satisfactory. The groups that will be here considered are:

1. Metalloids: ozone, oxygen, hydrogen peroxide, other peroxides, and oxidizing agents.

These act largely as active oxidizers

2. Metals and metallic salts. These act largely as protoplasm poisons, usually coagulating the albumin of the cell-body. Mercury, zinc, tin, copper, lead, aluminum, silver, etc.

3. Acids and alkalies.

4. Halogens and their combinations.

5. Bodies of the aromatic and fatty series, alcohols, aldehydes, anilines, phenols, volatile oils, etc.

I. OXIDIZING GERMICIDES.

Oxygen itself is not directly applicable as a germicide. In nature it undoubtedly plays an important part in general disinfection.

Ozone, O_3 , as a gas has a feeble germicidal action. Wyssokowitsch has shown that in a percentage of 20-30 miligrams to the 100 cubic meters it has a restraining action on the development of many bacteria. Ozone, according to the researches of Ransome and Fullerton, has no particular action on the vitality of the tubercle bacillus.

Ozone developed in water by electrical means has some bactericidal action, but it is highly doubtful if it is a practical method for water disinfection, the results of Schröder and Proskauer¹ notwithstanding.

Among the most useful of the oxidizing agents are the peroxides of hydrogen, and a number of recently introduced organic peroxides under the trade names of acetozone, alphazone, etc.

Åqua Hydrogēni Diōxidi—Åquæ Hydrogēni Diōxidi—Solution of Hydrogen Dioxide. U. S. P.

Origin.—A slightly acid, aqueous solution of hydrogen dioxide, which should contain, when freshly prepared, about 3 per cent. by weight of absolute hydrogen dioxide, corresponding to about 10 volumes of available oxygen.

Description and Properties.—A colorless liquid, without odor, slightly acridulous to the taste, and producing a peculiar sensation and a soapy froth in the mouth. liable to deteriorate with age or by exposure to heat or protracted agitation.

Dose.—1-4 fluidrams (3.7-15.0 Cc.), well diluted with water (1 fluidram (4 Cc.), U. S. P.).

Physiological Action.—*Externally and Locally.*—Applied to the skin it decomposes, but without much effect save in strong solution, when it irritates.

Applied to mucous membranes hydrogen peroxide is decomposed and oxygen is given off in large quantities. The oxygen given off is nascent and oxidizes surrounding substances very energetically. Applied to wounds or open surfaces the oxygen is given off in very large quantities.

In the stomach large quantities are also evolved, causing distention of the stomach in some instances. It is usually broken down completely before reaching the intestines.

Injected hypodermically oxygen is liberated, and if a blood-vessel is entered emboli of oxygen may form and it may thus cause death. Intravenous injection causes gas emboli and death.

The catalytic activity of the various organs after death varies considerably.

Therapeutics.—*Externally and Locally.*—Hydrogen dioxide is extensively employed to cleanse diseased surfaces, such as ulcers, buboes, fistulous tracts, etc. It has been highly recommended as an

¹ *Zeitschrift f. Hygiene*, vol. xli.

antiseptic in abdominal surgery. As an antiseptic wash in *empyema*, *cystitis*, *joint-cavities*, *venereal sores*, *puerperal septic endometritis*, etc., hydrogen dioxide is an exceedingly valuable agent.

Hydrogen dioxide appears to be an efficient injection in *gonorrhoea*, and is much used as an antiseptic in many diseases of the *eye*, *ear*, *nose* and *throat*. It has been highly recommended as an application for *diphtheritic membrane*, although when frequently applied to the throat it causes an unpleasant sensation of dryness. It is highly valuable in tonsillitis. It is to be recommended for loosening up necrotic tissue wherever applicable.

Hydrogen dioxide serves a useful purpose in disinfecting drinking-water when suspected of pollution, 1 part sufficing for 1000 parts of water, in which amount the taste or other potable qualities of the water are in no way impaired.

Internally it has no important actions yet carefully studied. It may prove of some value in gastro-intestinal affections, and its use in the rectum, where the gas may be absorbed, is said to be of value by some clinicians.

Administration.—For external and local use the drug may be gargled, sprayed, or applied with a syringe or a swab, either in full strength or diluted with water. Whether for external or internal use, the solution should be freshly prepared; when given internally it should be taken from a porcelain or china, not a metal, cup or spoon.

ORGANIC PEROXIDES.

Organic peroxides have recently been manufactured. By replacing one of the hydrogens in H_2O_2 , $HOOH$, by acetyl or benzoyl, $CH_3CO-O-OH$, $C_6H_5CO-O-OH$, acetyl peroxide and benzoyl peroxides are formed. Many others are possible, but as yet they are all comparatively unstable bodies. When two acetyl radicals are combined, $CH_3CO-O-O-COCH_3$, or acetyl and benzoyl, $CH_3CO-O-O-COC_6H_5$, a more stable series are formed. Acetozone and alphazone are of this general composition.

These organic peroxides have very powerful germicidal effects, and, moreover, as they split off their oxygen very slowly they have some important indications in gastro-intestinal affections that are not met by the more readily decomposable hydrogen peroxide.

They are valuable in gastric and intestinal fermentations and putrefactions, and have given some very striking results in limiting the distention in typhoid fever. That they can influence the disease process as a whole is hardly conceivable, by reason of the wide distribution of the typhoid bacillus, but these newer peracids have been useful in overcoming some of the distressing intestinal symptoms.

Whether they are to prove of service in increasing intracellular oxidative processes is a question of the future.

Both ACETOZONE and ALPHAZONE are used in solutions

A PEROXIDE OF BISMUTH, BiO_2 , has also been introduced of late

years. It is termed biogen commercially and it is claimed that it is valuable in increasing the oxidation functions of the body. It is used in doses of 5 to 10 grains.

CALCIUM PEROXIDE, *gonte*, is another of this general type. It is used as an intestinal disinfectant in 2- to 10-grain doses.

The persulphates of sodium and potassium, $\text{Na}_2\text{S}_2\text{O}_8$, PERSODINES, are commercially obtainable and are under investigation.

Potässii Permānganas—Potässii Permanganātis— Potassium Permanganate. U. S. P.

Definition.—It should contain not less than 99 per cent. of pure potassium permanganate.

Origin. Obtained by heating together caustic potash, potassium chlorate, and manganese dioxide. The potassium manganate formed is converted into the permanganate by boiling it in water.

Description and Properties.—Slender, monoclinic prisms, of a dark-purple color, almost opaque by transmitted light, and of a blue, metallic luster by reflected light, colorless, with at first a sweet and afterward a disagreeable and astringent taste; permanent in the air; soluble in 16 parts of water. In contact with alcohol it is decomposed.

Potassium permanganate should be kept in glass-stoppered bottles, protected from light, and should not be brought in contact with organic or readily oxidizable substances.

Dose.— $\frac{1}{4}$ -2 grains (0.03-0.12 Gm.), as a pill [1 grain (0.065 Gm.), U. S. P.].

Antagonists and Incompatibles.—Organic matter easily deoxidizes it, causing an explosion.

Synergists.—Other antiseptics enhance its germicidal action.

Physiological Action.—Potassium permanganate in contact with organic matter gives up a part of its oxygen. It loses its color thereby and is no longer active. Its action is very energetic but very superficial.

Therapeutics.—*Externally and Locally.*—In concentrated solutions or in substance it is a mild escharotic. Its readiness to part with oxygen renders it of great value as a deodorant, and in dilute solutions, 1 to 5 grains (0.06 to 0.32 Gm.) to 1 ounce (30 Cc.) of water, it is a useful application to *foul ulcers, cancer of the uterus, vagina, etc.* A solution of this drug is employed for various purposes as an antiseptic, germicide, and deodorant, in the treatment of *gonorrhea, leucorrhea, diphtheria, putrid sore throat, ozena, nasopharyngeal catarrh, cancer of the tongue, and syphilitic ulcers.*

A weak solution of POTASSIUM PERMANGANATE is an efficient application in *bromidrosis*, and a 1 : 2000 or 1 : 5000 solution is recommended in *purulent ophthalmia*. Potassium permanganate should not be used as an antiseptic in the peritoneal cavity, on account of its irritating properties. It is employed extensively in surgical practice for washing the hands and utensils.

Internally.—Like iron, POTASSIUM PERMANGANATE has been employed in *anemia*, although far inferior to the former drug. Favorable reports are given regarding its value in *gastric fermentation* and *lithiasis*.

It has been recently advocated as an antidote to *morphine-poisoning*. Later investigations do not support the early claims. It has an oxidizing effect and undoubtedly destroys the free morphine substances that may remain in the stomach or be eliminated there.

Administration.—For internal use potassium permanganate should always be given in pill form, kaolin being used as an excipient, lest an explosion occur.

II. METALS AND THEIR SALTS.

The metals and their salts as a class are treated elsewhere in this volume, but a few words may be said concerning their action as germicides. They act as such largely because of the property of precipitating or coagulating protoplasm. Some few of these coagula are soluble in an excess of the metal or its salts. In this case the action as a germicide may be penetrating, whereas, for the most part, the action of the metallic germicides is superficial.

It has been pointed out that the germicidal power of any substance varies within fairly wide limits, particularly with regard to the spore-bearing and non-spore-bearing forms.

III. ACIDS, ALKALIES, SALTS, ETC.

Many of the acids and alkalies are active antiseptics. In weak solutions hindering the organisms in their growth, in stronger solutions killing them by withdrawing water, by coagulation of protoplasm, or by other physico-chemical interchange.

For the acids, those that dissociate readily are more actively germicide, thus tri-chlor-acetic acid, by reason of its ready power of dissociation, is almost as efficient a germicide as the much more powerful nitric acid. Acetic and formic acids are relatively weak because of their diminished powers of dissociation.

Sulphuric, nitric, acetic, boric, and arsenous acids are the acids more commonly employed, while sodium, potassium, and ammonium hydrates, the various soaps, etc., are the alkalies used.

As these bodies for the greater part are considered in this work more in detail under the head of Caustics, etc., they are best consulted in those chapters. Only a few will be considered in this place.

Äcidum Sulphurōsum—Äcidi Sulphurōsi— Sulphurous Acid. *U. S. P.*

Origin.—A liquid composed of not less than 6 per cent. by weight of sulphur dioxide and about 94 per cent. of water.

Description and Properties.—A colorless liquid, of the characteristic odor of burning sulphur, and of a very acid, sulphureous taste. It should be kept in dark-colored, glass-stoppered bottles in a cool place, and protected from light.

Dose.— $\frac{1}{2}$ –2 minims (1.5–7.39 Cc) [30 minims (2 Cc), U. S. P.].

Physiological Action.—*Externally and Locally.*—Sulphurous acid is a powerful deoxidizing agent. It easily abstracts oxygen from organic bodies, the acid being a powerful disinfectant, antiseptic, deodorant, and parasiticide.

Internally.—The disinfecting properties of sulphurous acid are less apparent when the drug is ingested than when it is used externally.

Therapeutics.—*Externally and Locally.*—As an antiseptic, disinfectant, and deodorant sulphurous acid may be employed in the treatment of various *parasitic skin diseases*, and a solution of sulphurous acid affords an efficient application to the throat in *pharyngitis*, particularly the gangrenous form, *diphtheria*, etc.

According to Dujardin-Beaumetz, Sollaud, and Balhaud, non-febrile *pulmonary phthisis* is often favorably influenced by the daily inhalation for a short time of sulphurous-acid vapor. This disagreeable, not to say dangerous, method of treatment has neither been generally adopted nor proved to be of established efficacy.

The acid is a useful antiseptic to apply to recent *wounds*, and may be employed to disinfect the *dejections* of the sick. The fumes of sulphur are worthless as general disinfectants. They may be of service in killing mosquitoes, but dry fumes are practically inert so far as their action on bacteria is concerned. Burning sulphur as a means of disinfection is largely a fetish founded on ancient and superstitious ideas regarding infectious diseases.

Internally.—Sulphurous acid is seldom used internally, though, owing to its powerful antifermentative properties, it has been employed in so-called *fermentative dyspepsia*, *intestinal fermentation*, and *urticaria*. While it checks fermentation in the laboratory, its effect is less certain in the body; nor can the internal administration of the drug be regarded as satisfactory.

Administration.—Sulphurous acid should be given well diluted with water.

Sōdii Sūlphis—Sōdii Sulphitis—Sodium Sulphite.

U. S. P.

Origin.—Prepared by saturating a solution of sodium carbonate or caustic soda with sulphur dioxide gas. It should contain in the uneffloresced and air dried condition not less than 90 per cent. of pure sodium sulphite.

Description and Properties.—Colorless transparent, monoclinic prisms; odorless and having a cooling, saline, sulphurous taste. In the air the salt effloresces and is slowly oxidized to sulphate. Soluble in 2 parts of water, sparingly soluble in alcohol. It should be kept in well stoppered bottles, in a cool place.

Dose.—5–60 grains (0.3–4.0 Gm. [15 grains (1 Gm.), U. S. P.]).

Sōdii Bisūlphis Sōdii Bisulphitis Sodium Bisulphite. U. S. P.

Origin.—Prepared from sodium carbonate or bicarbonate and sulphur dioxide. It should contain not less than 90 per cent. of pure sodium bisulphite.

Description and Properties.—Opaque, prismatic crystals, or a granular powder, exhaling an odor of sulphur dioxide, and having a disagreeable, sulphurous

taste. Exposed to the air, the salt loses sulphur dioxide and is gradually oxidized to sulphate. Soluble in 3.5 parts of water and in 70 parts of alcohol. The drug should be kept in a cool place, in small, well-stoppered bottles, filled as full as possible.

Dose.—5-30 grains (0.3-2.0 Gm.) [7½ grains (0.5 Gm.), U. S. P.]

Sōdii Thiosūlphas—Sōdii Thiosulphātis—Sodium Thiosulphate. U. S. P.

Origin.—Prepared by passing sulphurous anhydride into a solution of sodium carbonate with salts. It should contain not less than 95 per cent of pure sodium thio sulphate.

Description and Properties.—Colorless, transparent, monoclinic prisms, odorless, and of a cooling, afterward bitter, taste. Soluble in 0.35 part of water at 25° C., insoluble in alcohol. It should be kept in well stoppered bottles.

Dose.—5-30 grains (0.3-1.3 Gm.) [15 grains (1 Gm.), U. S. P.]

Physiological Action and Therapeutics of Sodium Sulphite, Bisulphite, and Thiosulphite.—These substances are feeble germicides and antiseptics, checking putrefaction and other forms of fermentation. It is supposed that they are decomposed in the stomach, liberating sulphurous anhydride; on which assumption they have been given to arrest *gastric fermentation* and as remedies in *typhoid* and *yellow fevers*, *diphtheria*, *erysipelas*, etc. The hypothesis, however, upon which they have been thus hopefully employed has not been confirmed by clinical experience.

These drugs have nevertheless proved efficacious in the treatment of *scabies*, *syccosis*, *impetigo*, *farus*, etc. Atomized solutions of sodium hyposulphite inhaled are beneficial in *gangrene of the lungs*, *fetid bronchitis*, etc.

Administration.—The foregoing preparations of sulphur may be given in solution or in this form applied topically. The sodium thiosulphite may be applied in the form of an ointment.

BORIC ACID AND BORATES.

Acidum Bōricum—Acidi Bōrici—Boric Acid. U. S. P.

(BORACIC ACID.)

Origin.—Found native in Northern Tuscany. It may be prepared by the action of hydrochloric acid on borax, filtration, and recrystallization.

Description and Properties.—Transparent, colorless scales, of a somewhat pearly luster, or, when in perfect crystals, hexagonal plates, slightly sensitive to the touch, odorless, of a faintly bitterish taste, permanent in the air. Soluble in 25.6 parts of water, 15 parts of alcohol, and 10 parts of glycerin. The addition of hydrochloric acid increases its solubility in water.

Dose.—5-15 grains (0.32-1.0 Gm.)

Official Preparations.

Glyceritum Boroglycerini—Glyceriti Boroglycerini—Glycerite of Boroglycerin (GLYCERITE OF GLYCEROL BORATE SOLUTION OF BOROGLYCERIDE). Boric acid, 310; glycerin, to 1000. For external use.

Unguentum Acidi Bōrici—Unguenti Acidi Bōrici—Ointment of Boric Acid.—A 10 per cent ointment made with paraffin and white petrolatum. Similar to the Unguentum Acidi Bōrici of the British and German Pharmacopœias.

Liquor Antisepticus—Liquoris Antisepticus—Antiseptic Solution.—A solu-

tion of mild aromatics and antiseptics similar to certain commercial preparations. Among other things it contains about 2 per cent of boric acid, 0.1 per cent. each of benzoic acid and thymol, and 25 per cent. of alcohol.

Dose.—Average dose: 1 fluidram (4 Cc.), U. S. P.

Södiî Bôras—Södiî Borâtis—Sodium Borate.

U. S. P.

(BORAX)

Origin.—Prepared by boiling together solutions of boric acid and sodium carbonate, the borax crystallizing out. It is also found in a native state on the shores of certain lakes and as a crystalline deposit in the borax lake of California.

Description and Properties.—Colorless, transparent, monoclinic prisms, or a white powder, inodorous, and of a sweetish, alkaline taste; slightly efflorescent in warm, dry air; soluble in 10 parts of water and in 1 part of glycerin, insoluble in alcohol.

Dose.—5–30 grains (0.32–2.0 Gm.).

Antagonists and Incompatibles.—The incompatibles of BORAX are the acids and metallic salts. Morphine and cocaine are precipitated from solutions by BORAX. BORIC ACID is also incompatible with the carbonates and bicarbonates, and with the alkaline, earthy, and metallic bases.

Synergists.—The action of BORAX is enhanced by alkalies and substances promoting waste; that of BORIC ACID, by the antiseptics.

Physiological Action.—*Externally and Locally.*—BORAX is absorbent, protectant, sedative, and antiseptic. Applied to the unbroken skin, it acts upon the epidermis as a soap. By removing the stimulus to secretion and lessening irritation borax checks the secretion of the salivary glands.

BORIC ACID possesses properties similar to those of borax, although more of an antiseptic and antipruritic. It has also an exsiccant and detergent influence. It is a very weak acid and shows little hydrogen ion action.

Internally.—In a general way the action of BORAX is analogous to that of the alkalies. It is refrigerant and diuretic, and by its immediate action upon the womb serves as an emmenagogue, large doses contracting the uterine muscles and acting as an abortifacient. Excessive doses of either of these drugs act as gastro-intestinal irritants.

BORIC ACID, though stronger, resembles borax in its action. Both substances, especially boric acid, retard the action of saliva upon starch, increasing that of the pancreatic juice upon albuminous substances, and increase gastric digestion. Immoderate doses of BORIC ACID check gastric digestion.

The drug is a moderate antipyretic, and when injected in large amounts into the circulation may occasion paralysis of the motor nerves and muscles.

Absorption and Elimination—It is eliminated by the saliva, perspiration, feces, and urine, the latter being, according to Gies, diminished in quantity. The amount of nitrogen and solid matter ex-

creted with the feces is also increased, as well as the elimination of urea in the urine.

Untoward Action.—BORIC ACID absorbed from boric-acid dressings has occasioned the following untoward symptoms: frequent desire to micturate; nausea, vomiting, and other gastric disturbances; small, weak pulse; sleeplessness, muscular weakness, dimness of sight, depression, headache, hiccough, and various cutaneous eruptions, particularly eczema and psoriasis. Some of the untoward symptoms have seemed to arise in people who ate food preserved by borax (see Wiley's Report, U. S. Bureau of Chemistry).

Poisoning.—The symptoms of poisoning are analogous to those just described.

Treatment of Poisoning.—The treatment of poisoning should be symptomatic; stimulants, morphine, etc., being employed.

Therapeutics.—*Externally and Locally.*—Both borax and boric acids are valuable as local remedies in the treatment of many disorders of the ear, nose, and throat, such as *acute and chronic nasal catarrh*, *pharyngitis*, *gingivitis*, and *acute hoarseness*.

An efficient domestic remedy in *aphthæ* affecting the mouths of nursing children is a mixture of BORAX and honey.

An invaluable antiseptic application in *acute conjunctivitis* is a saturated solution of BORIC ACID, and the dry powder serves as an efficient remedy in *otorrhea*.

Leukorrhea, *gonorrhea*, and *chronic cystitis* are greatly benefited by solutions, in various strengths, of either or both of these drugs. Sir James Simpson recommends a solution of BORAX, 5-10 grains (0.32-0.6 Gm.) to 1 ounce (30.0 Cc.) of hot water, for the *eruption* occurring on the mucous membrane of the vulva in young girls.

It is invaluable as a bland, unirritating antiseptic in general surgery, and in diseases of the eye, ear, nose, throat, and skin.

It should be borne in mind, however, that the antibacterial action of these compounds is very slight, and only concentrated solutions are of any avail. In *otitis media* it can be used in alcoholic solution, the evaporation of the alcohol leaving the pure substance behind.

Internally.—BORAX is used internally more than boric acid. While in *epilepsy* inferior to the bromides, there are cases uninfluenced by the latter remedies which respond favorably to borax.

Its value in *epilepsy* is very questionable unless one ascribes it to its antibacterial action in the intestines, thus limiting putrefactive processes in this viscus.

In *chronic cystitis* 5-grain (0.3 Gm.) doses of BORIC ACID three times a day are useful.

These drugs have been used internally in the *summer diarrhea of children*.

Administration.—The remedies may be given in capsules or solution. The taste of borax may be disguised by coffee, syrup of orange, or aromatic elixir of licorice, the drug not being administered with glycerin, lest an acid reaction occur.

The newly introduced *liquor antisepticus* is a convenient mode to prescribe a cheap antiseptic lotion.

Potässii Dichrōmas—Potässii Dichromātis—Potassium Dichromate. U. S. P.

Origin.—Prepared by roasting in a reverberatory furnace potassium carbonate and chromic iron ore, with the addition of lime or chalk to prevent fusion. The potassium dichromate formed is separated by crystallization from its solution in water acidulated with sulphuric acid.

Description and Properties.—Large orange-red, transparent trichnic prisms or four-sided tables, odorless, and having a bitter, metallic taste. Permanent in the air, soluble in 19 parts of water; insoluble in alcohol.

Dose.— $\frac{1}{16}$ –1 grain (0.0006–0.06 Gm.) [$\frac{1}{2}$ grain (0.01 Gm.), U. S. P.].

Antagonists and Incompatibles.—Potassium dichromate is incompatible with soluble salts of silver, mercury, and lead, and with liquor potassæ, liquor sodæ, and ammonia water.

Synergists.—Agents promoting waste, antiseptics, and caustics.

Physiological Action.—*Externally and Locally.*—In substance potassium dichromate is an irritant caustic, and, according to Miquel, an antiseptic in the proportion of 1 to 909.

Internally.—Its action is nearly identical with that of potassium chlorate, with the additional properties of an expectorant, emetic, and mild alterative.

Poisoning and treatment of poisoning do not differ essentially from those of potassium chlorate.

Therapeutics.—*Externally and Locally.*—Potassium dichromate is used as a caustic for warts, corns, chancres, chancreoids, mucous patches, etc., and is also of considerable value as a gargle in pharyngitis.

Internally.—Frazer has recently recommended this drug in the treatment of dyspepsia and gastric ulcer, claiming that the pain, nausea, vomiting, and tenderness may be readily allayed by doses of $\frac{1}{2}$ to $\frac{1}{4}$ grain (0.005–0.01 Gm.), taken upon an empty stomach three times a day. In acute gastric ulcer he has perceived no benefit so far as its effect upon the hemorrhage is concerned, the most desirable action of the drug in the latter condition being derived from its antiseptic and analgesic influence.

Potassium dichromate, in doses of $\frac{1}{16}$ grain (0.0006 Gm.) every hour or two, has proven of service in aphonia and hoarseness due to excessive action of the vocal cords or resulting from an acute cold.

Potässii Chlōras—Potässii Chlorātis—Potassium Chlorate. U. S. P.

Origin.—Prepared by passing chlorine into a mixture of potassium carbonate and slaked lime. By subsequent boiling in water the chlorate separates by crystallization.

Description and Properties.—Colorless, lustrous, monoclinic prisms or plates, or a white powder, odorless, and having a cooling, saline taste; permanent in the air, soluble in 16 parts of water; insoluble in absolute alcohol. Potassium chlorate should be kept in glass stoppered bottles. Great caution should be observed in handling

the salt, since dangerous explosions are liable to occur when it is mixed with organic matters—cork, tannic acid, sugar, etc.—or with sulphur, antimony sulphide, phosphorus, or other easily oxidizable substance, or upon being either heated directly or subjected to trituration or concussion.

Dose.—3–20 grains (0.2–1.3 Gm.) [4 grains (0.25 Gm.), U. S. P.].

Official Preparation.

Trochisci Potassii Chloratis—**Trochiscos** (acc.) **Potassii Chloratis**—**Troches of Potassium Chlorate**.—Each troche contains $2\frac{1}{2}$ grains (0.15 Gm.).—**Dose**, 1 to 4 troches.

Antagonists and Incompatibles.—In addition to those substances mentioned with which potassium chlorate forms explosive compounds, mixture with glycerin and the hypophosphites is liable to produce similar dangerous results.

Synergists.—Agents promoting waste increase the activity of the drug.

Physiological Action.—*Externally and Locally.*—It is slightly detergent and stimulant, antiseptic and astringent, being irritant when applied in concentrated solution to ulcerated surfaces.

Internally.—**Digestive System.**—Beyond the cool, salty, and persistent taste medicinal doses have little effect; poisonous doses excite violent gastro-intestinal irritation, nausea, bloody vomiting, diarrhea, and jaundice.

Circulatory System.—Small doses of potassium chlorate tend to depress and subsequently raise arterial tension, accelerating the pulse; large doses lower arterial pressure alarmingly; toxic doses convert the hemoglobin of the blood into methemoglobin, the disorganized fluid appearing in the urine. Postmortem lesions are—enlargement of the liver, spleen, and kidneys, with evidences of marked inflammation over the whole intestinal tract.

Nervous System.—Medicinal doses are inert. Toxic doses may produce delirium and death, preceded by coma or convulsions.

Respiratory System.—Large doses act as a depressant to the respiratory apparatus.

Absorption and Elimination.—The drug is absorbed with considerable rapidity, being chiefly eliminated by the salivary glands unchanged. The drug does not increase the urinary flow, large doses, on the contrary, tending to suppress it.

Temperature.—Unaffected by medicinal doses, but lowered by toxic amounts.

Untoward Action.—Small doses of potassium chlorate seldom produce untoward symptoms, although in rare instances eruptions of an erythematous, papular, or vesicular nature have followed the use of the drug. Digestive disturbances occasionally ensue, as well as pain in the region of the kidneys and albuminuria.

Poisoning.—In a few recorded cases of poisoning there were observed a continuous sensation of choking, excessive thirst, persistent vomiting, pain in the abdomen and renal tract, and violent hiccough. Accompanying symptoms were—a small and rapid pulse and faintness, while the urine was albuminous and diminished

in quantity; epistaxis was present; the eyes and lips were cyanotic, and the skin slightly jaundiced and markedly anemic; the liver and spleen were slightly enlarged; and there were alternating sensations of cold and heat, with drowsiness, ending in coma and death.

Treatment of Poisoning.—The stomach should be emptied as quickly as possible and demulcents administered. The patient should be treated symptomatically, and it may be advisable to practice venesection, followed by transfusion of blood, as suggested by Landerer.

Therapeutics.—Externally and Locally.—A solution of this drug has been applied with some success in *foul ulcers* and *moist eczema*. Like the potassium permanganate, it has been employed in various diseases of the nose and throat, and is especially serviceable in *pyralism* and *aphthous ulceration*. As a remedy for *siphilic mucous patches* and *herpes of the buccal cavity* it is of considerable value. It is more efficient in *acute* than in *chronic pharyngitis*.

It possesses marked cicatrizing power, advantage of which property has been taken in the treatment of *phagedenic sores*, the powdered drug being used for this purpose. It is thought that enemas of potassium chlorate solution favor the healing of *rectal ulcers*.

Internally.—As a remedial agent this drug has not met with the success prophesied by many physicians. It has found some advocates as a *genito-urinary antiseptic* and as a remedy in *typhoid fever*.

Yet, notwithstanding the extravagant, though isolated, reports concerning the great value of the drug, its utility has not been universally recognized, indeed, so good an authority as Marchand declares that "chlorate of potassium should be entirely rejected in practice, and particularly in the treatment of children."

Administration.—It may be given in the form of troches, powder, tablets, or a solution, an agreeable means of administration being in aerated water. Owing to its tendency to decomposition when combined with other substances, the drug should be prescribed alone.

IV. HALOGENS.

The haloid compounds of fluorine, chlorine, bromine, and iodine all possess specific germicidal properties. They depend for their action on the presence of the freed haloid substance.

Fluorine is too active a substance to be handled, and only in exceptional cases are bromine-liberating compounds applicable. The halogens are only useful in the presence of a certain amount of moisture. A 2 per cent. solution of chlorine water is capable of acting on the anthrax bacillus spores in 15 seconds, and in proportions of 1:700 it will completely prevent the development of this micro-organism. The disinfecting power of the chlorine-containing compounds is much enhanced if nascent chlorine is being

formed. Chlorinated lime is a useful disinfectant for house purposes. Typhoid urine is well disinfected if the chlorinated lime is present in solution 1 : 500 to 1 : 1000 in five minutes. In the stools, the presence of albuminous material and salts makes it imperative to use this disinfectant as strong as 1 to 2 per cent., and have it act at least ten minutes.

Iodine used locally is a powerful germicide and it may also be used internally.

Iodine in combination with various aromatic or fatty bodies may be discussed here to advantage. The most characteristic of these bodies is iodoform. It is necessary that these bodies should liberate free iodine to be active germicides.

Liquor Chlōri Compōsitus—Liquōris Chlōri Compōsiti—Compound Solution of Chlorine. *U. S. P.*

Origin.—An aqueous solution of chlorine, containing when freshly prepared about 0.4 per cent. of chlorine, with some oxides of chlorine and potassium-chloride.

Description and Properties.—A clear, greenish-yellow liquid, having the suffocating odor and disagreeable taste of chlorine, and leaving no residue on evaporation. Chlorine water, even when kept from light and air, is apt to deteriorate; when it is required of full strength, it should be freshly prepared.

Dose.—1-4 fluidrams (3.7-15 c Cc) [1 dram (4 Cc.), *U. S. P.*].

Antagonists and Incompatibles.—The salts of lead and silver are incompatible.

Synergists.—The antiseptics are theoretically synergistic, though practically the drug is almost always used alone.

Physiological Action.—*Externally and Locally.*—Chlorine water is a powerful antiseptic, germicide, and deodorant. When applied to the skin it acts as a rubefacient and vesicant, while the vapor is distinctly irritating to the respiratory passages.

Internally.—Chlorine water is more or less irritating to the mucous membrane of the stomach, and possesses an astringent taste.

Therapeutics.—*Externally and Locally.*—Chlorine water is still occasionally used as an antiseptic and deodorant in *gangrenous* or *sloughing wounds* and for disinfecting *foul discharges*, etc. It has proved beneficial as a local application in *aphthous stomatitis*, *diphtheria*, and *parasitic skin diseases*.

Administration.—When given internally the drug should be well diluted. Should poisoning ensue from the ingestion of excessive amounts, albumen is the best antidote; for the irritation occasioned by the inhalation of chlorine gas steam-inhalations are indicated.

Cālx Chlorināta—Cālcis Chlorinātæ—Chlorinated Lime. *U. S. P.*

Origin.—A compound resulting from the action of chlorine upon calcium hydroxide, and containing not less than 35 per cent. of available chlorine.

Description and Properties.—A white or grayish-white, granular powder, exhaling the odor of hypochlorous acid, of a repulsive saline taste, and becoming moist and gradually decomposing on exposure to air. It is but partially soluble in water or alcohol. The drug should be kept in well-closed vessels, in a cool and dry place. Used externally.

Physiological Action and Therapeutics.—Chlorinated lime is a powerful disinfectant, yielding, when exposed to air, hypochlorous acid, which is resolved into chlorine and chloric acid, the last in turn yielding chlorine.

The effects of the drug are therefore analogous to those of chlorine, yet almost the only use which chlorinated lime serves is in disinfecting cesspools and utensils employed for receiving the dejections of invalids.

Liquor Sōdæ Chlorinātæ—Liquōris Sōdæ Chlorinātæ—Solution of Chlorinated Soda. U. S. P.

(LABARRAQUE'S SOLUTION.)

Origin.—An aqueous solution of several chlorine compounds of sodium, containing at least 2.4 per cent. by weight of available chlorine.

Description and Properties.—A clear, pale greenish liquid, having a faint odor of chlorine and a disagreeable alkaline taste. It should be kept in well stoppered bottles, protected from light. Used externally.

Physiological Action.—The action of the drug resembles that of aqua chlori, although it is feebler than the latter.

Therapeutics.—Solution of chlorinated soda is used as a disinfectant for *feet ulcers*, *gangrenous sores*, and *varicæ*, and as a disinfectant wash in *diseases of the uterus, vagina, and auditory canal*.

Administration.—There are no special directions to be observed in the application of this solution.

Iodoformum—Iodoförmi—Iodoform. U. S. P.

Definition.—Triiodomethane, usually obtained by the action of iodine upon alcohol, in the presence of an alkali or alkali carbonate.

Description and Properties.—Small, lemon yellow, lustrous crystals, of the hexagonal system, having a peculiar, very penetrating, and persistent odor, somewhat resembling that of salicin and iodine, and an unpleasant, slightly sweetish, and iodine-like taste. It is very slightly soluble in water, to which, however, it imparts its odor and taste, soluble in about 46.7 parts of alcohol, in about 12 parts of boiling alcohol, or in 5.2 parts of ether, and very soluble in chloroform, benzine, and fixed and volatile oils.

Iodoform is slightly volatile, even at ordinary temperatures, and in boiling water distils slowly over with its vapor. It should be kept in well stoppered bottles, in a cool and dark place.

Iodoform contains 96.69 per cent. of its weight as iodine.

Dose.—4-3 grains (0.000-0.2 Gm.) [4 grains = 250 (mg.), U. S. P.].

Official Preparation.

Unguentum Iodoformi—Unguenti Iodoformi—Ointment of Iodoform.—10 per cent. Used externally.

Iodolum—Iodōli—Iodol. U. S. P.

Definition.—Tetraiodopyrrol, a derivative of the base pyrrol (C_4H_5N), obtained by the direct action of iodine upon the base in the presence of alcohol.

Description and Properties.—A light, granular brown, crystalline powder without odor or taste. Very slightly soluble in water (1:4900), much more so in alcohol (1:19), soluble in fixed oils.

Dose.—Average dose: 0.250 Gm. = 250 milligrammes (4 grains, U. S. P.)

This is one of the vast number of compounds proposed in the last few years as substitutes for iodoform. The iodine of iodol is apparently less easily split off the molecule than that of iodoform, and it is said to be less liable to produce poisoning. Iodol contains about 88.57 per cent. of iodine.

Allied Compounds.

Antiseptol—Cinchonine Iodosulphate.—*Origin.*—It is prepared by mixing an aqueous solution of cinchonine sulphate with an aqueous solution of iodine and potassium iodide, and washing and drying the resulting precipitate.

Description and Properties.—It occurs as a light reddish brown powder, insoluble in water, but soluble in alcohol and chloroform. It contains about 50 per cent. of iodine.

Dose.—1-3 grains (0.06-0.2 Gm.)

Aristol—Dithymol Diiodide.—*Origin.*—It is obtained by adding a solution of iodated iodide of potassium to an aqueous solution of hydrate of sodium containing thymol. The resulting precipitate is washed and subsequently dried at ordinary temperature.

Description and Properties.—A dark, brownish-red, amorphous, almost tasteless powder, of a slight, peculiar, iodine-like odor, insoluble in water and glycerin, sparingly soluble in alcohol, but readily soluble in ether, collodion, and chloroform. It is also taken up by fixed oils, petrolatum, etc.

Aristol is decomposed by heat and light, and it should be kept in dark amber-colored, well stoppered bottles. It contains 45.8 per cent. of iodine.

Dose.—It is not given internally.

Europhen.—Prepared in a manner analogous to that of preparing aristol, except that isobutylthiocresol is used in place of thymol.

Description and Properties.—An amorphous, yellow powder, having an odor resembling saffron; soluble in ether, chloroform, and fixed oils; insoluble in water and glycerin. It is permanent in dry air, but when moistened with water resolves into iodine, forming a new soluble iodine compound. When heated to 110° C. (230° F.) it melts, forming a clear brown liquid. It contains 27.6 per cent. of iodine.

Dose.— $\frac{1}{4}$ -1½ grains (0.016-0.09 Gm.) It is used hypodermically in olive oil, and externally in the form of an ointment, in strengths varying from 3 to 10 per cent.

Antagonists and Incompatibles.—It is incompatible with the preparations of mercury and zinc, with metallic oxides, and with starch.

Lozophan.—*Origin.*—Prepared by slowly adding an aqueous solution of iodine and iodide of potassium to an aqueous solution of ortho-cyanipic acid and sodium bicarbonate. The precipitate formed is washed with water and recrystallized from alcohol.

Description and Properties.—It occurs as colorless, odorless, needle-shaped crystals. Insoluble in water and alcohol, but readily soluble in ether, benzene, chloroform, and fixed oils. It contains 78.30 per cent. of iodine.

Dose.—It is used externally.

Soroiodol.—*Origin.*—A combination of iodine 34 per cent., carbolic acid 20 per cent., and sulphur 7 per cent.

Description and Properties.—The sodium, potassium, ammonium, mercury, lead, and zinc salts of this acid are the preparations used, the sodium salt being the one most commonly employed. The sodium soroiodolate occurs in bright, prismatic, needle-shaped crystals. Soluble in water, alcohol, and glycerin.

Dose.—For external use, in strengths varying from 3 to 20 per cent.

Sulphaminol.—*Origin.*—It is formed by the action of sulphur on the salts of metaoxy diphenylamine.

Description and Properties.—It is a yellow powder, insoluble in water, readily soluble in alkalis, alcohol, and glacial acetic acid.

Dose.—1 to 4 grains (0.066-0.25 Gm.)

Other compounds of iodine used for much the same purposes are: *Iatrol*, aniline iodine, an antiseptic powder; *Iamidol*, a substitute for iodoform; *Iousimalol*, a rubefacient and antiseptic; *Iodocetarin*, a yellow powder with faint iodine odor; *Iodineol*, carbol and potassium iodide and soda; odorless substitute for iodoform; *Iodoformol*, with odor like vanilla, also an iodoform substitute; *Iodoformogen*, albumin and iodoform; *Iodophenol*, bismuth iodide and gallicin, antiseptic; *Iodoesterin*, iodine and turpin, dark brown liquid, substitute for tincture of iodine or iodoform; *Iodothymol*, an iodized thymol-formaldehyde preparation, a yellow powder rich in iodine. *Nephren*, *antiodine*, *iodoxine*, are aniline compounds of phenolphthalein. *Iosetan* and *iodosetum*, compounds of creosol and iodine. *Aristol*, a 20 per cent. iodine compound with bismuth and gallic acid.

Antagonists and Incompatibles.—Iodoform is incompatible with mercuric chloride.

Physiological Action.—*Externally and Locally.*—Iodoform or-

dinarily possesses no irritating action when applied to the skin or mucous membranes, or to ulcers and wounds. On the contrary, it possesses analgesic properties. It has a tendency to check serous oozing when applied to wounds. It has a limited action in hindering the growth of bacteria when in alkaline serum, but as a dry powder it seems to possess little bactericidal action.

Internally.—Digestive System.—Small doses, if they have any effect, slightly increase the appetite, and tend to increase the salivary, biliary, and intestinal secretions. Large doses disturb the stomach, and may occasion nausea, vomiting, and diarrhea.

Circulatory System.—Small doses retard and strengthen the pulse, and, for a brief period only, increase arterial tension. Full medicinal doses lessen arterial tension and render the pulse slower and weaker. Lethal doses rapidly accelerate the pulse, causing it to become irregular; later, the action of the heart is slowed, and finally arrested in diastole, from paralysis of the cardiac muscle.

Nervous System.—Large doses are apt to produce headache, restlessness, delirium, or stupor. The reflexes may be depressed, or in some cases choreic movements may appear. Muscular contractility and the excitability of the nerve-centers to external stimulation are lessened.

Respiratory System.—Very large doses produce convulsive respiratory movements.

Absorption and Elimination.—Iodoform is absorbed from the stomach, or from mucous membranes or wounds to which it is applied. It is slowly absorbed from the alimentary canal, but readily absorbed from wounds. In the tissues it combines with the proteid molecules, and is retained in the system in part as potassium iodide and other iodides. Free iodoform is, however, found in the body, else poisoning would probably not develop. It is eliminated in all the secretions, and has been detected in the urine and saliva within one hour after its administration, traces of it being perceptible in the secretions for three days. Iodine is liberated at the points of elimination, either as an iodate or as some organic compound of iodine, or both. The drug is also detected in the breath, though it is chiefly eliminated in the urine as alkaline sodium iodate, coloring the urine yellow. It should be remembered that iodoform is absorbed much more rapidly than it is eliminated.

Temperature.—Large doses cause a rise of temperature, while poisonous doses may, at the last, produce a decided reduction of animal heat.

Untoward Action.—Sometimes iodoform excites an eczematous eruption, which may be papular or erythematous, and symptoms of vertigo. Muscular weakness and double vision have also been observed; sleepiness, alternating with excitement, incoherence of speech; headache; mental confusion, and amblyopia.

Poisoning.—Three forms of poisoning by iodoform are described by Duret—the eruptive, the cerebral, and the syncopal. The relation of iodoform to the methane group is to be borne in mind.

No two cases of poisoning present the same symptoms, hence every case should be considered a law unto itself and be treated accordingly. With reference to fatal doses, 75 grains (5 Gm.), administered over a period of one week, have caused death.

In the first of these there may be a severe and extensive erythema or eczematous eruption. The cerebral variety is characterized by an increase of temperature and accelerated pulse—as high as 150 or 175 per minute; great irritation of the gastro-intestinal tract; widely dilated, or motionless and contracted, pupils; intense headache over the entire circumference of the head, insomnia, restlessness, melancholia; great depression of spirits or hallucinations and active delirium or suicidal mania.

In the syncopal variety the patient complains of dizziness and mental confusion, is languid and weak; he suffers from insomnia, is restless, and unable to keep quiet. He may develop hallucinations either of an exciting or depressing nature, and may develop violent delirium; the heart's action becomes very rapid and feeble, the patient passing at length into a lethargic or comatose condition, with paralysis of the sphincters, and finally dying, perhaps quite suddenly.

The symptoms of poisoning may appear soon after the application of the drug, or they may be deferred for days and even weeks. In the latter case, which may properly be termed chronic poisoning, the patient is more apt to be depressed, weak, and apathetic with slight fever and accelerated pulse. Old people are the more susceptible to its toxic influence.

Treatment of Poisoning.—Every particle of the drug should be immediately removed from the body and its internal administration be discontinued at once. Stimulants, diaphoretics, and diuretics should be given, with frequent bathing of the body in warm water, to hasten elimination. Opium and large doses of potassium bicarbonate have been recommended.

Therapeutics.—Externally and Locally.—IODOFORM acts as an alterative, analgesic, protectant, antiseptic, and germicide to at least some forms of bacilli. Its extremely disagreeable odor does not commend it for anything. Odorless compounds with similar actions are much to be preferred. It is a valuable application to wounds, ulcers, etc. It is especially valuable in the treatment of tuberculous affections, such as tuberculous joints, when it is used in the form of an injection—10 to 20 per cent.—in sterilized olive oil. In tuberculous parenchymatous synovitis the mixture is injected directly into the joint-cavity.

Iodoform is an exceedingly valuable application to syphilitic ulcers, chancres, chancreoids, suppurating buboes, ulcerations of the uterus, uterine cancer, and indolent and irritable ulcerations of the leg.

Incorporated in a suppository, it is very efficacious in painful hemorrhoids, fistula, and fissure of the anus.

It is a valuable application in many diseases of the ear, nose, throat, eye, and skin, where a drug of this character is indicated.

Internally.—IODOFORM is used but very little internally, and has no particular indications.

The allied compounds here mentioned are used locally as substitutes for iodoform. Most of them possess the great advantage of being odorless, and some of them seem to be in all respects quite as efficient as iodoform. ARISTOL is undoubtedly superior to it in the treatment of *indolent ulcers* and in many *diseases of the skin, ear, nose, and throat*. EUCROPHEN and IODOL should certainly replace iodoform in many cases.

Administration.—Internally, iodoform should be given in pills or capsules. Externally, it may be used in the form of a powder, alone or mixed with powdered borax or boric acid. It is also used in the form of an ointment or collodion. It is given hypodermically, mixed with olive oil and glycenn, or dissolved in ether, in strengths varying from 10 to 30 per cent.

Its disagreeable odor may be modified or disguised by mixing it with tar, liquid styrax, balsam of Peru, thymol, coumarin, menthol, ground coffee, oil of lavender, bergamot, bitter almond, coriander, musk, vanilla, or some similar aromatic and pleasantly odorous substance. At best, however, it is almost impossible to eradicate the disagreeable odor.

V. AROMATIC AND FATTY COMPOUNDS.

This group is a large one. The differing compounds, modifications of the benzol nucleus, make a distinct series with closely related properties.

Phēnol—Phenōlis—Phenol. U. S. P.

(ACIDUM CARBOLICUM, U. S. P. 1890.)

Definition.—Hydroxybenzene, obtained either from coal tar by fractional distillation and subsequent purification, or made synthetically. It should contain not less than 90 per cent. of absolute phenol.

Description and Properties.—Colorless, interfused, or separate needle-shaped crystals, or a white, crystalline mass, sometimes acquiring a reddish tint, having a characteristic, somewhat aromatic, odor, also, when copiously diluted with water, a sweetish taste, with a slightly burning after-taste. Deliquescent on exposure to damp air.

Soluble in about 19.6 parts of water, the solubility varying according to the degree of hydration of the acid; very soluble in alcohol, ether, chloroform, benzol, carbon disulphide, glycenn, and hard and volatile oils. It is liquefied by the addition of about 8 per cent. of water. The vapor of the acid is highly inflammable. Carbolic acid is faintly acid to litmus paper. It should be kept in dark, amber-colored, well-stoppered bottles.

Dose.— $\frac{1}{2}$ –2 grains (0.03–0.12 Gm.). If liquefied, 1–2 minims (0.03–0.12 Cc.) [1 grain = 0.05 Gm., U. S. P.]

Official Preparations.

Glyceritum Phenōlis. Glyceriti Phenōlis. Glycerite of Phenol (20 per cent. [5 minims 0.11 Cc., U. S. P.])—For external use.

Unguētum Phenōlis. Unguēti Phenōlis. Ointment of Phenol (3 per cent.).—For external use.

mically. Digitalis and coffee may also be required. Opium, or some preparation of it, for the relief of pain.

Alcohol is an efficient antidote if promptly given. Locally applied, it prevents the caustic action of even pure phenol.

Therapeutics.—*Externally and Locally.*—For some time after it was so prominently brought forward by Lister carbolic acid was thought to be indispensable in antiseptic surgery. It is now known that the solutions which are safe to use are inefficient, ordinarily, beyond the mere mechanical effect of washing.

The benumbing influence produced on the hands of the surgeon, and the discoloration of bright instruments and rapid impairment of their cutting surfaces, render strong solutions for disinfecting instruments impracticable, and, indeed, of less value for this purpose than the prolonged boiling in distilled water rendered slightly alkaline with sodium bicarbonate.

The pain of superficial burns is relieved by applying strong solutions of carbolic acid, care being taken to prevent absorption.

It is an extremely valuable drug as an antipruritic, and is hence of great utility in the treatment of certain diseases of the skin—*pruritus, chronic eczema*. In *chilblains, tinea tonsurans, tinea capitis, tinea circinata, favus*, etc., it is of value. *Chronic laryngitis*, characterized by diminished secretion, is greatly benefited by the direct application to the parts of a solution of $\frac{1}{2}$ dram to 1 ounce of glycerin (2.0-30.0 Cc.). A spray containing from 2 to 5 grains (0.12-0.36 Gm.) to 1 ounce (30.0 Cc.) of water is an efficient application in the treatment of acute and chronic inflammation of the throat and nose.

As a deodorant it is valuable to correct the fetor arising from syphilitic ulcerations, carcinoma, gangrene of the lungs, bronchorrhea, pneumothorax, etc.

It reduces the discharge and relieves the pain in acute *otitis media*: a 10 per cent. solution in glycerin should be used. It is also of value in the treatment of *otorrhea* and in acute perforations of the tympanic membrane, but should be used in much weaker solutions—1 or 2 per cent.

A lotion, 8 to 15 grains (0.5-1.0 Gm.) to 1 ounce (30.0 Cc.), is an efficient antiseptic in foul and indolent ulcers.

The pure acid is used as a cauterant in chancrels, lupus, gangrene, bites of rabid animals, etc.

The iodized carbolic acid is a valued local remedy in *endometritis, chronic endocervicitis*, and ulcers of the cervix.

Crude carbolic acid is useful as a disinfectant.

Internally.—While inferior to salicylic acid to check fermentation, it is nevertheless used for that purpose in dilatation of the stomach and so-called fermentative, or flatulent, dyspepsia.

In nervous and irritative vomiting it may be given in doses of from 1 to 2 minims (0.06-0.12 Cc.), well diluted and repeated at intervals of from one to four hours according to the symptoms of the case.

It has been used in *acute* and *chronic* dysentery, and as an anthelmintic against *ascarides* and *tœnia solium*.

It has also been advocated as a remedy for *typhoid fever* and in *malarial cachexia*, but purely upon hypothetical grounds, no clinical results having thus far justified its use in these disorders.

Administration.—It may be given internally in pills or capsules, mixed with powdered licorice-root as an excipient, or dissolved in glycerin and well diluted with sweetened water.

For external use various strengths are used (from 1:10 to 1:500), and the various preparations mentioned may be used according to the case and indications. It is to be noted that a strength above 1:10 is liable to produce vesication, and that even in 2 per cent. solutions it has caused gangrene of the part to which it has for some time been applied.

Crēsöl—Cresōlis—Cresol. U. S. P.

Definition.—A mixture ($C_6H_4 \begin{smallmatrix} CH_3 \\ OH \end{smallmatrix}$) of three isomeric cresols obtained from coal tar, freed from phenol, hydrocarbons, and water.

Description and Properties.—A colorless or straw-colored refractive liquid having a phenol-like odor and turning yellowish brown on prolonged exposure to light. Sometimes erroneously called creylic acid. Cresol is methyl phenol, the three isomeric forms being known chemically as ortho, meta, and paracresol.

Soluble in water (1:60) and miscible in all proportions with alcohol and glycerin. Miscible with alkali hydroxide solutions, forming alkali cresolates, homologous with alkali phenicates.

Dose.—Average dose: 1 minim (0.05 Cc.). U. S. P.

Hunt writes "much has been written concerning the germicidal and toxic properties of cresol. It is generally held that cresol is more toxic to bacteria than is phenol, but that it is less toxic to higher animals than is the latter." Tollens (*Arch. f. exper. Path. u. Pharm.*, liii, p. 220, 1905) finds that paracresol is more than twice as toxic for mice as is phenol, orthocresol has the same toxicity, while metacresol is less toxic. Thus the toxicity of a cresol will depend upon the relative proportion of the three constituents, and these seem to vary in different preparations. Tollens finds some specimens to be more toxic than phenol. The U. S. Pharmacopœia does not specifically state the proportions in which the three cresols are present, although it fixes limits for the boiling-point, specific gravity, and solubility. A preparation on the market under the name of *tricrosol* (*enterol*) is said to contain 35 per cent. of orthocresol, 40 per cent. of metacresol, and 25 per cent. of paracresol; it is soluble to the extent of 2.2 to 2.55 per cent. in water. The physiological action of the cresols is almost identical with that of phenol.

The cresols are constituents of coal tar and other crude antiseptic substances. Being but slightly soluble in water, they are often used in the form of emulsions or are dissolved with the aid of salts or of soap. The official *Liquor Cresolis Compositus* (q. v.) belongs to the latter class; it is practically identical with the *Liquor*

Cresol saponatus of the German Pharmacopœia and the preparation on the market known as *lysol*.

Liquor Cresolis Compōsitus—Liquōris Cresōlis Compōsiti—Compound Solution of Cresol. U. S. P.

Definition—Liquor Cresoli Saponatus is the official German title of a somewhat unique preparation. It is essentially a lard-sap solution of cresol of 50 per cent. strength, the soap dissolves the cresol as do alkalies. This is a mixture of much more definite composition than many commercial preparations of similar nature. For practical use the 50 per cent. solution is diluted with water to various degrees according to need.

(CRUDE CARBOLIC ACID AND CRESOLS.)

Within recent years a number of preparations made from the higher phenols of crude carbonic acid, particularly the cresols, have been placed on the market as disinfectants, and a word should be said concerning their composition and their usefulness. For the most part their composition is extremely complex. They are mixtures of many constituents. Some of the more commonly used are:

1. **Sapocarbol-Cresolin**—"Carbolic Soaps."—This is a mixture of crude cresols ($C_6H_3(OH)CH_3$) with pyridin bases, hydrocarbons dissolved in resin soaps.

2. **Saprol**.—A mixture of crude cresols, with petroleum remnants, hydrocarbons, and pyridin bases.

3. **Cresolin**.—A mixture of the higher raw phenols from oil in resin soap with an alkaline reaction. Its composition is thought to be hydrocarbons, 45 per cent.; phenols, 13 per cent. (phenol, cresol, xyleneol, phlorol); pyridin bases, 2-3 per cent.; resin, 32 per cent.; water, 5-6 per cent.

A 4-5 per cent. solution in water has been used as a germicide in obstetrics, but its cloudy appearance made it unpopular.

4. **Lysol**.—A 50 per cent. solution of the comparatively pure cresols in potassium soap. It is a widely employed germicide in gynecology, and is very useful in 1/2-1 per cent. solution.

It occasionally is swallowed by accident. 1 dram has killed a ten months' old child in thirty-six hours. 25 Gm. of lysol has been recovered from, although the symptoms were exceedingly severe. Poisoning has occurred by its use as a uterine douche.

5. **Salvol** is a mixture of cresol in sodium cresolate.

6. **Solutol**.—A solution of crude cresols in sodium cresolate.

7. **Tricresol**.—A mixture of the three pure cresols.

Ortho-meta- and paracresol, soluble in 2-2 1/2 parts of water, is used as an expectorant and respiratory antiseptic.

The pure cresols are about as poisonous as phenol (Medi. Inaug. Dissert., Bern, 1891), but the symptoms of poisoning may be somewhat delayed. As antiseptics Hammerl (*Hygiene der Kunstsch.,* 12, No. 20) has shown that ortho- and paracresol are stronger than carbolic acid.

Resorcinol—Resorcinōlis—Resorcinol. U. S. P.

Definition—A diatomic phenol [meta-hydroxybenzene, $C_6H_3(OH)_2$, 13] obtained usually by the reaction of fused sodium hydroxide upon sodium metabenzene-disulphonate.

Origin—Prepared by melting gallanum ammoniac, or guaiacum resin with potash. It is also prepared in a similar manner from asphaltum, saparatum, ascaroid resin, and from benolsulphonic acid and other derivatives from phenol.

Description and Properties—Colorless or faintly reddish, needle-shaped crystals, or rhombic plates, having a faint, peculiar odor, and a disagreeable sweetish and afterward pungent taste. Resorcinol acquires a pinkish or brownish tint by exposure to light and air, and should be kept in dark amber-colored vials. It is soluble in 0.5 part of water, more in alcohol, very soluble in boiling water and in boiling alcohol, readily soluble in ether and glycerin, and very slightly soluble in chloroform. The aqueous solution is neutral or only faintly acid to litmus paper.

Dose.—3-8 grains (to 2-0.5 Gm.) [2 grains—125 Gm., U. S. P.]

Allied and Derivative Compounds.

Hydroquinol—Hydroquinone—Hydrochinone—Paradioxybenzene.—Colorless, odorless, dimorphous crystals, having a sweetish taste. Soluble in 17 parts of water, very soluble in hot water, alcohol, and ether. Dose, 1½–5 grams (0.05–0.30 Gm.).

Catechol—Pyrocatechin—Orthodioxybenzene.—Acicular crystals, readily soluble in water, alcohol, and ether.

Other allied compounds are—thioresorcin, resopyrine, and fluorescein.

Physiological Action.—Pyrocatechin, resorcin, and hydroquinone, ortho-, meta- and paradioxybenzols, agree practically in all their actions. Pyrocatechin and resorcin are comparatively soluble in water. Hydroquinone is less so. They irritate the central nervous system, more particularly the spinal cord. Resorcin is the least irritating and poisonous of the three: 10 Gm. has been taken without causing death. Pyrocatechin is the most active, both locally and internally. It is more poisonous than phenol.

Therapeutics.—*Externally and Locally.*—Resorcin is especially useful in certain subacute or chronic skin affections, and may be used like salicylic acid in *indurated eczema*. It is of great value in *psoriasis, seborrhoea sicca, pityriasis capitis, sycois, acne rosacea*, etc.

A 5 to 10 per cent. solution is an efficient application in *pharyngitis, diphtheria*, and *ulcerative laryngitis*. An ointment of resorcin is an excellent application to *foul ulcers, sloughing wounds*, and *syphilitic ulcers*.

Condylomata have been cured by dusting upon them powdered resorcin.

A mixture of powdered resorcin and boric acid (1:20 or 1:10) has been used with brilliant results in *suppuration of the middle ear*.

A 2 per cent. solution has been found useful in the form of a spray in *whooping-cough*, while stronger solutions of 10 or 20 per cent. have been used with some success in *hay fever*.

Solutions of resorcin have been used in *gonorrhea* and *cystitis*.

Internally.—Resorcin is preferable to carbolic acid for internal administration, especially in digestive disorders, such as *gastralgia, chronic gastritis, ulcer of the stomach*, and *fermentative dyspepsia*, so called. Owing to its sedative and antifermentative properties, it is of value in *acute diarrhea* of children.

It has been used with some success in *intermittent fever*, but not with good results sufficiently uniform to justify the exclusion of quinine. As an antipyretic it may be used when a drug of that character is indicated, but it is not equal to antipyrine or acetanilid, and in doses sufficient to produce the desired reduction of temperature it is too depressant to the heart. Its chief therapeutic value is for external or local use, and internally for the digestive disorders above mentioned.

Administration.—It should be given in pills or capsules.

The TRIOXYBENZOLS, $C_6H_3(OH)_3$, pyrogallol (1, 2, 3), oxhydrochinon (1, 2, 4), and phloroglucin (1, 3, 5), are occasionally used in

medicine. Pyrogallol is widely employed as a hair dye, is also employed in the treatment of psoriasis, and widely used in photography. It is highly poisonous. It behaves in a large measure like phenol, but in addition has a marked destructive action on the blood. Oxyhemoglobin is changed into methemoglobin and hemolysis also is energetic.

Phloroglucin used internally causes a peculiar type of diabetes.

Other hydrocarbons of this general group, such as benzol, toluol, xylol, are liquids and not useful, but naphthalin, a solid member of the series, and some of its derivatives, are therapeutically possible.

Naphthalēnum—Naphthalēni—Naphthalene.

U. S. P.

Origin.—A hydrocarbon ($C_{10}H_8$) obtained from coal tar.

Description and Properties.—Colorless, shining, transparent laminae, having a strong, characteristic odor resembling that of coal tar and a burning, aromatic taste; slowly volatilized on exposure to air. Insoluble in water, but when boiled in it imparting a faint odor and taste. Soluble in 15 parts of alcohol, and very soluble in boiling alcohol; also very soluble in ether, chloroform, carbon disulphide, and in fixed or volatile oils. Naphthalene volatilizes slowly at ordinary temperatures, but rapidly when heated. Its vapor is inflammable, burning with a luminous and smoky flame. It should be kept in well-stoppered bottles.

Dose.—2-10 grains (0.12-0.6 Gm.) [2 grains (0.125 Gm.), *U. S. P.*]

Bētanāphthol—Bētanaphthōlis—Betanaphthol.

U. S. P.

Origin.—A monatomic phenol occurring in coal-tar, but usually prepared artificially from naphthalene.

Description and Properties.—Colorless or pale buff colored, shining, crystalline laminae, or a white or yellowish white crystalline powder, having a faint, phenol-like odor, and a sharp, pungent, but not persistent, taste. Permanent in the air. Soluble in about 95 parts of water, in 0.6 part of alcohol at 25° C. (77° F.), in about 75 parts of boiling water, and very soluble in boiling alcohol, ether, chloroform, and solutions of caustic alkalis. It should be kept in dark amber-colored, well stoppered bottles.

Dose.—2-10 grains (0.12-0.6 Gm.) [4 grains (0.250 Gm.), *U. S. P.*]

Antagonists and Incompatibles.—Physiological antagonists of NAPHTHALENE are the same as for other members of this group. BETANAPHTHOL is incompatible with subacetate of lead.

Synergists.—Carbolic acid and its derivatives.

Physiological Action.—NAPHTHALENE is antiseptic, antifermentative, disinfectant, and deodorant. Its action is quite similar to phenol. It is insoluble in the gastric juices, but to some extent soluble in the intestines, where it acts as an antiseptic by local contact, deodorizing the stools and often imparting to them its own odor. It is absorbed to some extent, and is eliminated by the lungs and kidneys, but escapes principally in the feces. It has been known to irritate the kidneys. It is broken up into naphthol or dioxynaphthalene, and acts as a local antiseptic and disinfectant at points of elimination, but does not occasion any local irritation unless quite large doses have been taken: 15 grains (1.0 Gm.)

daily have occasioned frequent micturition, with burning pain, vesical tenesmus, and redness of the urethral orifice. Purdy states that in certain cases of genito-urinary disease he has known a dose of 5 grains (0.32 Gm.) to cause severe suffering along the whole urinary tract. It is a stimulant expectorant. Its use is thought to bring about a cloudiness of the crystalline lens.

BETANAPHTHOL is quickly absorbed when applied locally. It produces considerable irritation when used in solution, but has no irritating effect when applied in the form of ointment. Toxic effects may result from its absorption by the skin, their character resembling the action of carbolic acid.

Therapeutics.—*Externally and Locally.*—NAPHTHALENE is recommended in the treatment of *scabies* and other *parasitic skin diseases*.

Internally.—It is used in *typhoid fever* and in the *gastro-intestinal and genito-urinary disorders* for which salol and carbolic acid are administered, such as *chronic diarrhea* and *dysentery*, *acute or chronic cystitis*, etc.

The internal uses of BETANAPHTHOL are the same as those of naphthalene, while externally it may be employed, like carbolic acid or creasote, as a general antiseptic in *cutaneous disorders*, whether organic or parasitic.

Allied Compounds.

Alumol.—An almost colorless, non-hygroscopic powder; readily soluble in cold water or glycerin, less soluble in alcohol, and insoluble in ether. It is employed as a local remedy in solutions varying in strength from 1 to 50 per cent. Used externally. It is aluminium naphtho-disulphonate.

Asaprol. A colorless, neutral crystalline powder, soluble in 1½ parts of water and 3 parts of alcohol. *Dose*, 15–60 grains (1.0–4.0 Gm.) Beta naphthol sodium sulphate. It is prescribed as an antipyretic.

Besonaphthol.—Obtained by the action of benzoic chloride on beta naphthol in a sand bath. It is an odorless, tasteless white, crystalline powder, or occurs in the form of long needles. Insoluble in cold water. *Dose*, 4–8 grains (0.18–0.5 Gm.)

Betol. *Naphthalol-Sodiumphenol.*—A substance analogous to salol, and prepared in the same manner, except that sodium naphthol is used instead of sodium phenol. It occurs as a colorless, odorless, tasteless, lustrous crystalline powder. Insoluble in water or glycerin, and with difficulty soluble in cold alcohol. *Dose*, 2–5 grains (0.12–0.3 Gm.)

Camphorated Naphthol.—Obtained by mixing 1 part of beta-naphthol with 2 parts of camphor. It is a brownish, transparent, sticky liquid.

Hydronaphthol. A derivative of beta naphthol, obtained by the action of reducing agents. It occurs in scale like crystals of a silvery white or grayish hue of slightly aromatic odor and taste. Soluble in 1100 parts of water, and freely soluble in alcohol, ether, glycerin, benzene, chloroform, and fixed oils. *Dose*, 2–3 grains (0.12–0.18 Gm.)

ASAPROL, BETOL, and HYDRONAPHTHOL are best given in capsules, although betol, which is tasteless and insoluble in water, may be administered in the form of powders.

ALUMOL.—An efficient remedy in many *acute and chronic inflammatory diseases of the skin*, and in *gonorrhea*, *chancres*, *sypilitic ulcers*, *balanitis*, etc. A 1 per cent solution may be injected in gonorrhea, while stronger solutions (10–50 per cent.), or alumol plaster, are recommended in *chronic diseases of the skin*.

ASAPROL.—Given for the same purposes as salicylic acid and the salicylates, although it is not so uniformly successful in *acute articular rheumatism*, while having the advantage of causing less heart-depression.

BETOL.—Used chiefly in the *bowel complaints of children*. It may be administered either by the mouth or through the rectum, associated with bismuth or antacids. It has been used also in *acute articular rheumatism* and *bladder affections*.

CAMPHORATED NAPHTHOL is considered by some practitioners to be superior to all other remedies to prevent suppuration in *acute tonsillitis*.

Fernet has employed it successfully in *tuberculous ulcerations of the tongue*, while Reboul, of Marseilles, and others have adopted it with good effect hypodermically in *tuberculous adenitis* and *tuberculosis of the testis*. It has also been used in *tuberculosis of the bladder, joints, etc.*

Ruault claims it to be an efficient local application to the turbinated bones in *ozena*.

HYDRONAPHTHOL.—Considered by many physicians to be superior to carbolic acid, since it is without disagreeable odor and can be used without exciting irritation or danger of toxic impression.

Dockrell employs it in the form of a plaster for destroying the trichophyton fungus of *trinea tonsurans*, and believes it to be superior to mercuric chloride as a germicide.

It has been used as a preventive of *dental caries*, and in the treatment of *gingivitis, pyorrhea alveolaris, diphtheria, etc.*

Internally it has been recommended in *dysentery, diarrhea, pulmonary tuberculosis, and typhoid fever*.

Contraindications.—These preparations should not be given internally when the functional activity of the kidneys is defective.

Administration.—**NAPHTHALENE** is best given internally in the form of pills or in capsules. When it is necessary to use it topically, the offensive odor of the drug may be disguised, it is said, by triturating it with a small quantity of the oil of bergamot. **BETA-NAPHTHOL** should be given in capsules, in the dose recommended, three times a day or oftener if necessary.

THE PHENOL ETHERS.

To this group belong creosote and its constituents. The most important of these phenol ethers are:

1. Anisol: Methylphenol ether, $C_6H_5OCH_3$.
2. Phenetol: Ethylphenol ether, $C_6H_5OC_2H_5$.
3. Guaiacol: Monomethyl ether of pyrocatechin, $C_6H_4(OH).OCH_3$.
4. Creosol: Methylguaiacol, $C_8H_7CH_3OCH_3.OH$.
5. Creosote: A mixture of varying composition of 60–90 per cent, guaiacol, creosol, methylcreosol, $C_6H_2CH_3.CH_3OCH_3.OH$, xylenol, $C_6H_4CH_3.CH_3OH$, and phlorol, $C_6H_4C_2H_5.OH$, and usually made of beechwood.

Creosotes of commerce from species of pine consist of much less guaiacol, more creosol, phenols, cresols, veratrol, and hydrocarbons. Pure beechwood creosote should not contain any phenols or cresols.

Creosötum—Creosöti—Creosote. U. S. P.

Origin.—A mixture of phenols and phenol derivatives, chiefly guaiacol and creosol, obtained during the distillation of wood-tar, preferably that derived from the *Fagus montana* L. or *Fagus sylvatica* Mill. beech.

Description and Properties.—An almost colorless, yellowish or pinkish, highly refractive, oily liquid, having a penetrating smoky odor, and a burning caustic taste, usually becoming darker in tint on exposure to light. Soluble in about 150 parts of water, but without forming a perfectly clear solution. With 120 parts of hot water it forms a clear liquid which on cooling becomes turbid, from the separation of minute oily drops. Soluble in all proportions in absolute alcohol, in ether, chloroform, benzoin, carbon disulphide, acetic acid, and in fixed and volatile oils. Creosote is inflammable, burning with a luminous, smoky flame. It is neutral, or only faintly acid, to litmus paper.

Dose.—1-5 minims (0.06-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.]

Official Preparations.

Aqua Creosoti—Aque Creosoti—Creosote Water.—*Dose*, 1-4 fluidrams (4.0-15.0 Cc.) [2 drams (8 Cc.), U. S. P.]

Incompatibles.—Strong sulphuric and nitric acids. It reduces silver salts, and explodes when combined with oxide of silver.

Synergists.—The same as for carbolic acid.

Physiological Action.—*Externally.*—It has an action similar to phenol.

Internally.—Its action upon the digestive, circulatory, nervous, and respiratory systems is practically the same as that of carbolic acid.

It does not stimulate the spinal cord so much as carbolic acid, and differs also from the latter drug in increasing the coagulability of the blood. Poisonous doses act like those of carbolic acid, but with more marked nervous symptoms.

Absorption and Elimination.—It is eliminated by the bronchial mucous membrane, and by the kidneys as guaiacol sulphate and creosol sulphate of potassium.

It is a stimulant expectorant.

It has the property when applied to meat of preserving it, whence its name (*creas*, flesh, *sohzo*, preserve).

Poisoning.—The symptoms and treatment of poisoning from creosote are the same as described under *Carbolic Acid*.

Therapeutics.—*Externally and Locally.*—Creosote is superior to carbolic acid as an antipruritic, although not so generally used as the latter, on account of its acid and penetrating odor. It can be used externally for the same purposes as carbolic acid. It is a valuable hemostatic, and the creosote water may be used for this purpose.

Inhalations of creosote are recommended in *phthisis*, *chronic*

bronchitis, and chronic congestion of the larynx and trachea. It is a powerful local anesthetic, and is largely used by dentists and the laity for *aching teeth*. It is used to preserve dead animal matter for *dissection, etc.*

Internally.—Creosote can be used internally for the same purposes as carbolic acid, having the advantage over the latter drug in being one of the most efficient remedies in *pulmonary tuberculosis*. Probably no one remedy exerts so favorable an action upon the night sweats, cough, and expectoration as creosote, or guaiacol, which is preferred by many physicians. It is of less value in cases accompanied by high temperature and hemoptysis, and often aggravates these symptoms.

It must be remembered that many of the cases alleged to have been cured by creosote have been treated with cod-liver oil, tonics, and hygienic methods as well. Creosote undoubtedly limits the amount of secondary infections in phthisis and it is also stomachic. Many patients do badly with creosote and eminent phthisiologists deprecate its use.

Contraindications.—The same as for carbolic acid.

Administration.—Pure beechwood creosote alone should be used. It may be given in the form of creosote water, emulsion, or pills, or in capsules mixed with cod-liver oil. Capsules are the least offensive way of administration. Some persons prefer to take the drug in milk.

In the treatment of phthisis large doses are necessary. A tolerance can usually be established by gradually increasing doses. If the patient manifest any untoward symptoms, the drug must be reduced in quantity or discontinued altogether.

Guaiacol—Guaiacölis—Guaiacol. U. S. P.

Definition.—One of the chief constituents of creosote; prepared either from beechwood tar, or synthetically.

Description and Properties.—Either a clear, colorless or light yellow, oily fluid, or colorless, prismatic crystals, which melt at 28.5° C. It has an agreeable aromatic odor.

Chemically it is the monomethyl ether of pyrocatechin (orthodihydroxy benzene), $C_6H_4(OH)(OCH_3)$ 1.2.

Soluble in water (1:53), glycerin (1:1), and easily in alcohol. Being phenolic in character, it readily dissolves in caustic alkalis and forms salts with a large number of acids, one of which the carbonate has been made official. Of late years creosote has been largely superseded by guaiacol, upon which the value of creosote in large part depends.

Dose.—2-10 minims (0.12-0.6 Cc.) [8 minims (0.5 Cc.), U. S. P.].

The following derivatives have been introduced:

Guaiacolis Carbonas—Guaiacolia Carbonatis—Guaiacol Carbonate (U. S. P.)—*Definition.*—A guaiacol derivative ($C_6H_4(OCH_3)(OC_2O_2)$), obtained by the action of carbonyl chloride upon sodium guaiacolate. Also known as *dustol*.

Description and Properties.—A white, crystalline, neutral powder, nearly odorless and tasteless. Insoluble in water, soluble in cold (1:45), more so in hot, alcohol; slightly soluble in glycerin and fatty oils.

Dose.—Average dose 15 grains (1 Gm.), U. S. P.

Guaiacolia Benzoas—Guaiacolis Benzoatis—Guaiacol Benzoate (BENTOSOL).

—*Origin*, by heating on a water bath potassium guaiacol with benzosol-chloride: the impure benzosol guaiacol formed is purified by recrystallization from alcohol.

Description and Properties.—Colorless, tasteless, and odorless crystalline powder, almost insoluble in water, but readily soluble in ether, chloroform, and hot alcohol.

Dose.—10-150 grains (0.60-10 Gm.) daily.

Guaiacolis Duodidum—**Guaiacolis Duodidi**—**Guaiacol Duodide**.—*Origin*, by adding a solution of iodine in potassium iodide to an aqueous solution of sodium-guaiacol as long as precipitation continues.

Description and Properties.—Reddish brown salt, having the odor of iodine, soluble in alcohol and fixed oils, and readily decomposed.

Dose.—2-15 grains (0.10-1 Gm.).

Guaiacolis Salicylas—**Guaiacolis Salicylatus**—**Guaiacol Salicylate** (**GUAIACOL SATUR**).—*Origin*, by the action of phosphorous oxychloride on a mixture of sodium-guaiacol and salicylate. It is analogous to salol.

Description and Properties.—White, crystalline, odorless, and tasteless powder, insoluble in water, but soluble in alcohol, ether, and chloroform.

Dose.—10-150 grains (0.60-10 Gm.) daily.

Physiological Action of Guaiacol and its Derivatives.—

GUAIACOL produces an action very similar to that of creosote. It is not caustic when applied in full strength. It possesses marked antipyretic properties. It is readily absorbed through the unbroken skin, and rapidly reduces febrile temperature when applied in this manner. The reduction of temperature lasts from four to six hours.

It is a diaphoretic and diuretic. It is excreted by the sweat, saliva, and urine, but is only slightly thrown out by the expired air, though small amounts of the drug have been found in the lung-tissue. As it is eliminated as a salt of ethyl-sulphuric acid, it must combine with albuminous bodies in the blood, and chiefly through the sulphur present in the albumin molecule. It can be found in the urine within fifteen minutes after administration or external application in the form of a substance giving the reaction of phenol.

It is more agreeable to the stomach than creosote, and frequently improves the appetite, though to some patients it is very disagreeable and acts as an irritant.

The **GUAIACOL CARBONATE** is usually much better borne by the stomach, and is therefore a useful and efficient substitute.

BENZOSOL, **GUAIACOL BENZOATE**, contains 54 per cent. of guaiacol. It is usually well borne by the patient, and seldom occasions any digestive disturbance. In the intestinal canal it resolves into guaiacol and benzoic acid, and is excreted by the urine as combinations of these substances.

Therapeutics.—**GUAIACOL** is used for the same purposes as creosote—less likely to irritate the intestinal canal and kidneys.

GUAIACOL causes a marked reduction of the temperature in cases of *tuberculous disease*, when applied locally, nor is the antipyretic action when thus employed confined to tuberculous cases. It has given satisfactory results in other pyrexias. It is a very active antipyretic in *erysipelas*. The temperature begins to fall within fifteen or twenty minutes after the application of the drug. As with all antipyretics, the depressing action of guaiacol must be borne in mind.

Raymond first suggested the local application of guaiacol in *tonsillitis*. It undoubtedly exerts a favorable action on the disease.

Contraindications.—The same as for creosote.

Administration.—The solid derivatives of guaiacol may be given in powders or capsules. Guaiacol itself may be given in the same manner as creosote—preferably, mixed with cod-liver oil or enclosed in capsules.

Sōdii Phenolsulphōnas—Sōdii Phenolsulphonātis— Sodium Phenolsulphonate. U. S. P.

(SODIUM SULPHOCARBOLATE. U. S. P., 1900.)

Description and Properties.—Colorless, transparent, rhombic prisms, odorless, having a cooling, saline, slightly bitter taste. Somewhat effervescent in dry air. Soluble in 4.8 parts of water, 1.32 parts of alcohol, 0.7 part of boiling water, and in 10 parts of boiling alcohol. The aqueous solution is neutral to litmus paper. It should contain not less than 90 per cent. of pure sodium. Paraphenolsulphonate, $C_6H_4(OH)SO_3Na$.

Dose.—10–30 grains (0.60–2 Gm.) [4 grains (0.250 Gm.), U. S. P.].

Allied Compounds.

Potassii Sulphocarbolas—**Potassii Sulphocarbolutis**—**Potassium Sulphocarbonate**.

Calcii Sulphocarbolas—**Calcii Sulphocarbolutis**—**Calcium Sulphocarbonate**.

Magnesi Sulphocarbolas—**Magnesi Sulphocarbolutis**—**Magnesium Sulphocarbonate**.

Zinci Sulphocarbolas—**Zinci Sulphocarbolutis**—**Zinc Sulphocarbonate**.

All of the above have been employed, but the zinc sulphocarbonate is believed to be preferable to check diarrhea, and render the stools less foul. It is best given in pills, in doses of 2–3 grains (0.1–0.15 Gm.).

Physiological Action.—In medicinal doses SODIUM PHENOL-SULPHONATE occasions no special symptoms, and in three or four times the medicinal dose it causes only slight lightness of the head.

It is changed in the system into carbolic acid and sodium sulphate, the latter being eliminated with the urine. The carbolic acid set free exerts its characteristic action and influence.

Therapeutics.—*Externally and Locally.*—In the strength of $\frac{1}{2}$ dram (20 Gm.) to 8 ounces (237.0 Cc.) of water it forms a valuable gargle in *relaxed conditions of the throat*.

Solutions of different strengths have been used in *diphtheria*, *acute tonsillitis*, *aphthae* of children, and *nasal catarrh*.

Thirty grains (20 Gm.) in 2 ounces (60.0 Cc.) each, of water, and hydrogen peroxide make an efficient injection in *gonorrhea*.

Internally—It is a mild intestinal antiseptic, and may be used internally for the same purposes as carbolic acid in such disorders as *diarrhea*, *fermentative dyspepsia*, etc. It arrests the growth of *thrush*, and is considered by some physicians to exert a favorable action in *anginose scarlatina*, *diphtheria*, and *typhoid fever*. The ZINC SULPHOCARBOLATE is one of the best intestinal antiseptics to use in cases of *dyspeptic diarrhea* of children.

Administration.—Sodium phenolsulphonate is best given in solution.

Ichthyolum—Ichthyöl—Ichthyol. (*Non-official.*)

Origin.—It is obtained by the destructive distillation of bituminous rock found near Seefeld in the Tyroese Alps, which contains enormous quantities of semifossilized fishes and marine animals.

Description and Properties.—It occurs in the form of a brownish yellow, transparent, oily liquid, containing about 10 per cent. of sulphur.

Upon being treated with concentrated sulphuric acid ichthyol is converted into ichthyol-sulphonic acid, which readily combines with ammonia and other alkalis, as well as with lithium, zinc, mercury, etc., forming the ammonium ichthyol, sodium ichthyol, zinc ichthyol, etc.

AMMONIUM ICHTHYOL occurs as a clear reddish brown, syrupy liquid with a bituminous odor and taste. Soluble in water and in a mixture of equal volumes of ether and alcohol.

Dose.—2-10 minims (0.12-0.6 Cc.).

The other salts of ichthyol-sulphonic acid occur as brownish or black tar-like masses, the sodium salt being the most important, as it is the one most employed when ichthyol is desirable in full form.

Dose.—Sodium ichthyol, 2-4 grains (0.1-0.25 Gm.).

Alled Drugs.

Thiolum—Thioli—Thiol.—*Origin*—This substance is prepared by heating brown-colored paraffin or gas oils with sulphur, and extracting the sulphurated, unsaturated hydrocarbons with alcohol.

Description and Properties.—It occurs as a neutral, solid body, non-hygroscopic and soluble in water, and of a dark brown color, or in the form of a dark reddish brown, syrupy liquid, containing about 40 per cent. of thiol.

Dose.—½-1 gram (0.03-0.06 Gm.).

Tumenolum—Tumenol—Tumenol.—*Origin*—It is obtained from purified mineral oils by the direct action of concentrated sulphuric acid, without previous sulphuration, being a mixture of sulphones and sulphonic acids.

Description and Properties.—A dark brown or blackish brown liquid of a syrupy consistence.

Dose.—It is used only externally, in strengths of from 5 to 10 per cent.

Antagonists and Incompatibles.—Ichthyol possesses marked reducing properties, and should not therefore be combined with substances, like potassium permanganate, which part readily with oxygen.

Synergists.—Most members of this group, particularly the tars, carbolic acid, creosote, etc., and its action.

Physiological Action.—*Externally and Locally.*—Ichthyol is ischemic, sedative, parasiticide, and possesses antiseptic and probably disinfectant, properties.

When applied to the skin in full strength it produces some irritation. It is readily absorbed, having the power to penetrate the skin, affecting the deeper tissues beneath.

Internally.—**Digestive System.**—Very large doses produce considerable gastro-intestinal irritation.

Circulatory System.—It has the power in medicinal doses of contracting the caliber of the arteries, and in large doses it increases the migration of the white blood-corpuscles.

The physiological action has not been fully studied, and it is

not yet positively known what action it has upon the nervous and respiratory systems and upon temperature.

Therapeutics.—*Externally and Locally.*—Ichthyol was introduced by Unna as a valuable remedy in certain diseases of the skin. It is particularly useful in *erythematous eczema*, *erysipelas*, *lupus erythematosus*, *irritable acne*, and certain forms of *acne rosacea*.

Agnew has employed it with advantage in *lymphatic enlargements*. It has also been found useful in *synovial inflammations*, *inflammatory conditions of the female genital organs*, and in certain diseases of the ear and nose.

Thiol, although inferior, is similar to ichthyol in its therapeutic action. It has been found to be valuable in the treatment of *herpes zoster*, *dermatitis herpetiformis*, and *erythema multiforme*.

Administration.—Ichthyol, when given internally, should be dispensed in capsules, while thiol may be given in capsules, pills, or wine.

Externally, ichthyol may be employed in solution, dissolved in chloroform or in a mixture of alcohol and ether, and applied with a brush; or in the form of an ointment mixed with soft petrolatum or lanolin in from 1–4 to 8 drams (4–15 Cc. to 32 Gm.). It is used also in the form of a soap in from 5 to 20 per cent. strength.

Thiol is used locally in powder form, or as an ointment of 5 to 10 per cent. of the liquid, or in collodion containing 5 per cent. of the powder, or in solutions of glycerin and aqueous solutions containing from 5 to 50 per cent. of the powder.

AROMATIC ACIDS.

These are characterized by their greatly reduced toxic action by means of the introduction of the acid radical, COOH . The most important are benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, and ortho-oxybenzoic acid or salicylic acid, $\text{C}_6\text{H}_4(\text{OH})\text{COOH}$.

Benzoinum—Benzoini—Benzoin. U. S. P.

Origin.—A balsamic resin obtained from *Styrax Benzoin* Dravetter and other unidentified species of *Styrax*. A large tree indigenous in Sumatra and Java, and probably in Cochinchina and Siam.

Description and Properties.—Benzoin exudes from incisions in the bark, and upon exposure to the air hardens into lumps consisting of agglutinated, yellowish-brown tears, which are internally milk-white, or in the form of a redish-brown mass, more or less mottled from whitish tears imbedded in it. It is almost wholly soluble in 5 parts of moderately warm alcohol and in solutions of the fixed alkalies. When heated it gives off fumes of benzoic acid. It has an agreeable balsamic odor and a slight aromatic taste.

Benzoin is of the nature of a balsam, containing from 20 to 24 per cent. of benzoic acid, resin, and volatile oil. Some varieties contain cinnamic acid, which is undesirable, while the benzoin from Siam contains vanillin and possesses the odor of vanilla.

Dose.—Benzoin is rarely administered in substance. [15 grams (1 Gm.), U. S. P.].

Official Preparations.

Adeps Benzoinatus—Adipis Benzoinati Benzoinated Lard (2 per cent.).—For external use.

Tinctura Benzoini—**Tinctura Benzoini**—Tincture of Benzoin (20 per cent).
Dose, 30 minims to 1 fluidram (2-4 Cc.) [15 minims (1 Cc.), U. S. P.]

Tinctura Benzoini Composita—**Tinctura Benzoini Composita**—Compound Tincture of Benzoin.—Benzoin, 10; aloes, 2; storax, 8; tolu, 4; alcohol, q. s. *parts*. *Dose*, $\frac{1}{2}$ -2 fluidrams (2-8 Cc.) [30 minims (2 Cc.), U. S. P.]

Antagonists and Incompatibles.—The tincture and compound tincture are incompatible with aqueous preparations, the benzoins and other resins and balsams being precipitated from their alcoholic solutions by water.

Physiological Action.—The action of benzoin is due to the benzoic acid which it contains, and will therefore be considered under Benzoic Acid.

Acidum Benzōicum—Acidi Benzōici—Benzoic Acid. U. S. P.

Origin.—An organic acid, C_6H_5COOH , obtained from benzoin by sublimation, or prepared artificially.

Description and Properties.—White or yellowish white, lustrous scales or friable scales, having a slight characteristic odor resembling that of benzoin, and of a warm acid taste; somewhat volatile at a moderately warm temperature, and rendered darker by exposure to light. Soluble, when pure, in about 281 parts of water, in 2 parts of alcohol at about $25^{\circ} C$ ($77^{\circ} F$), in 15 parts of boiling water, and in 1 part of boiling alcohol. It is also soluble in 3 parts of ether, 7 parts of chloroform, and readily soluble in carbon disulphide, in benzol, and in fixed and volatile oils. Sparingly soluble in benzoin.

Benzoic acid has an acid reaction and is inflammable. It should be kept in dark amber colored, wellstoppered bottles, in a cool place.

Dose.—5-15 grains (0.3-1 Gm.) [$7\frac{1}{2}$ grains (0.5 Gm.), U. S. P.]

Official Salts of Benzoic Acid.

Ammonii Benzoeas—**Ammonii Benzoatis**—**Ammonium Benzoate** (U. S. P.).—*Origin*.—Dissolve benzoin acid in water of ammonia and distilled water, evaporate, and crystallize. It should contain not less than 98 per cent. of pure ammonium benzoate, $C_6H_5COONH_4$.

Description and Properties.—Thin, white, four-sided laminar crystals; odorless, or having a slight odor of benzoic acid; a saline, bitter, afterward slightly acid taste, and gradually losing ammonia on exposure to air. Soluble, at $25^{\circ} C$ ($77^{\circ} F$) in 10.5 parts of water, in 25 parts of alcohol, in 1.2 parts of boiling water, and in 7.0 parts of boiling alcohol. The salt is neutral or has a very slight reaction upon litmus-paper. It should be kept in well stoppered bottles.

Dose.—10-20 grains (0.7-1.2 Gm.) [15 grains (1 Gm.), U. S. P.]

Lithii Benzoeas—**Lithii Benzoatis**—**Lithium Benzoate** (U. S. P.).—*Origin*.—Prepare by decomposing lithium carbonate with benzoic acid. It should contain not less than 98.5 per cent. of pure lithium benzoate.

Description and Properties.—A light white powder, or small, shining, crystalline scales, colorless or of a faint, benzoin-like odor, and of a cooling, sweetish taste; permanent in the air. Soluble in 3 parts of water, in 13 parts of alcohol and 2.5 parts of boiling water, and in 10 parts of boiling alcohol. The presence of sodium benzoate increases the solubility in water and lessens it in alcohol. The aqueous solution (1:20) lithium benzoate has a faintly acid reaction upon litmus.

Dose.—5-20 grains (0.3-1.2 Gm.) [15 grains (1 Gm.), U. S. P.]

Sodii Benzoeas—**Sodii Benzoatis**—**Sodium Benzoate** (U. S. P.).—*Origin*.—Prepare by decomposing sodium carbonate with benzoic acid. It should contain not less than 99 per cent. of pure sodium benzoate, C_6H_5COONa .

Description and Properties.—A white amorphous powder, odorless or having a faint odor of benzoin, and a sweetish, astringent taste. *Dose*.—in 1.6 parts of water, in 43

parts of alcohol at 25° C (77° F), in 1.3 parts of boiling water, and in 20 parts of boiling alcohol. The aqueous solution is neutral to litmus-paper. It is effervescent, and should be kept in well-stoppered bottles.

Dose.—5-30 grains (0.3-2 Gm.) [15 grains (1 Gm.), U. S. P.].

Allied and Unofficial Preparations.

Bismuthi Benzoea.—**Bismuthi Benzoatis**.—**Benzoate of Bismuth**.

Menthhol Benzoea.—**Menthhol Benzoatis**. **Benzoate of Menthol**.—For external use.

Other benzoic combinations of interest are: *Benzamilid*, an antipyretic for children. *Dose*, 1-8 grains (0.1-0.5 Gm.). *Benzonaphthol*, analogous to betol, intestinal antiseptic in doses of 4-8 grains (0.25-0.5 Gm.). *Benzolol*, a guaiacol benzene, used as an antiseptic and for the same general purposes as guaiacol. *Dose*, 4-8 grains (0.25-0.5 Gm.). Peronin, tropococaine, saccharin, orthotorm, anesthesin, and β -eucaine are all benzoyl compounds.

Antagonists and Incompatibles.—**BENZOIC ACID** is incompatible with the alkaline salts, as those of sodium, etc., and **AMMONIUM BENZOATE** is incompatible with the ferric salts.

Physiological Action.—**Externally**.—When applied in a concentrated form to the skin or mucous membrane **BENZOIC ACID** is an irritant, and produces a catarrhal condition of the bronchial mucous membrane when its vapors are inhaled. It is a powerful antiseptic and germicide, preventing the growth of putrefactive bacteria in a solution of 1:1000.

Internally.—**Digestive System**.—In full medicinal doses **BENZOIC ACID** irritates the throat and produces a sense of heat in the epigastrium. Very large doses may occasion gastric inflammation with nausea and vomiting. The functional activity of the liver is stimulated by sodium benzoate.

Circulatory System.—In large doses **BENZOIC ACID** increases the pulse-rate to a marked extent, and is a stimulant to the entire circulatory apparatus. Slowing follows from vagus stimulation.

Nervous System.—There is evidence to show that benzoic acid quiets the higher cerebral centers.

Respiratory System.—It is a powerful stimulant in moderate medicinal doses, increasing the respiratory movements and promoting the bronchial secretion.

Absorption and Elimination.—It is eliminated chiefly by the kidneys, but also by the skin, salivary glands, and bronchopulmonary mucous membrane.

An important action of **BENZOIC ACID** is the change it undergoes in the body, being converted into hippuric acid, in combination with glycocholl. Some benzoic acid is eliminated unchanged, the hippuric acid formed renders alkaline urine acid, besides increasing the urinary flow and disinfecting and stimulating the genito-urinary tract. A copper-reducing body may also be found in the urine.

Temperature.—Like other members of this group, the acid, as well as its salts, possesses antipyretic properties, many observers holding it to be equal, if not superior, to salicylic acid in this respect. It is not yet known in what manner it reduces temperature.

Untoward Action.—BENZOIC ACID sometimes produces urticaria or an erythematous condition of the skin.

Therapeutics.—Externally and Locally.—The COMPOUND TINCTURE OF BENZOIN is an admirable preparation for many conditions requiring antiseptic, astringent, and stimulating dressing. It is frequently applied to *cutaneous wounds*, the alcohol evaporating and leaving upon the injured parts a protective film of balsams. A piece of lint or absorbent cotton saturated with the compound tincture has been used to close the punctures in the skin after tenotomy.

Stille recommends a combination of the compound tincture of benzoin and glycerin for the treatment of *chapped hands and lips, frost-bite, fissured and chapped nipples*.

The compound tincture, diluted with water in various proportions, makes an efficient application in *catarrhal affections of the pharynx and larynx*, either in the beginning of an inflammation or during the relaxed condition which so often accompanies the termination of an acute attack. The *hoarseness* of vocalists and public speakers, the result of excessive strain upon the vocal cords, is frequently relieved by this remedy, particularly as inhaled with hot steam.

Inhalations of BENZOIN are a popular and frequently effective method of treating *acute catarrhal inflammation* of the upper respiratory passages.

The *cough* and *expectoration* of *chronic bronchitis* and *chronic phthisis* are eased and lessened by inhaling night and morning 1 dram (4 Gm.) of BENZOIC ACID, added to boiling water.

A preparation like the following is an efficient and agreeable lotion for irritative forms of *chronic nasal catarrh*:

R	Sodii boratis,	℥ii (60.0 Gm.);
	Aq. benzoini,	℥r x (10.0 Gm.)

M et hat pulvis No. 1.

Sig. To half a tumblerful of water add half a teaspoonful each of the powder and glycerin. Use freely as a lotion.

The simple TINCTURE OF BENZOIN is an excellent application to *spongy gums*. There is much evidence of the efficiency of BISMUTH BENZOATE as a dressing for *chronic or sloughing ulcers*. *Specific sores, chancrels* and *chancre*s especially, are well treated by dusting the parts with the benzoate after thoroughly bathing the surface with a weak solution of bichloride of mercury.

Probably the most important therapeutic action of BENZOIC ACID is shown in the treatment of *cystitis* and *pyelitis*, which are complicated with decomposing and alkaline urine.

Phosphatic *calculus* may be dissolved by the prolonged administration of AMMONIUM BENZOATE, which is preferable to benzoic acid for this purpose. *Incontinence of urine*, if due simply to the alkalinity of the urine, is relieved by the same remedy.

Liégeois has employed SODIUM BENZOATE as a *cholagogue* with

excellent results. He associates it with rhubarb. He also states that benzoate of sodium favorably modifies the pain of *pharyngitis*. Sodium benzoate is an excellent substitute for sodium salicylate, being especially useful in the *septic diseases*. It is equally powerful as an antiseptic and antipyretic, though slower in its action than sodium salicylate. Its effects, however, are more permanent and innocuous.

Administration.—Benzoic acid is best administered in pill form or in capsules, with balsam of fir or Castile soap as an excipient. The soluble benzoates may be given in solution in some aromatic water or in compressed pills. The solution, however, is preferable, and the unpleasant taste may be well disguised by a little spirit of chloroform. When any of these preparations are given for their action upon the urinary tract, it may sometimes be advantageous to combine them with a urinary sedative, such as tincture of belladonna or hyoscyamus.

Äcidum Salicylicum—Äcidi Salicylici—Salicylic Acid. U. S. P.

Origin.—A monobasic organic acid ($C_6H_4(OH)COOH$ 1 : 2) existing naturally in combination in various plants (like *Spiraea nemosa* meadow sweet), *Gaultheria procumbens* (wintergreen), etc.), but chiefly prepared synthetically by combining the elements of pure carbonic acid with dry carbonic acid and purifying.

Description and Properties.—Light, fine, white prismatic needles, or a light white crystalline powder, odorless, having a sweetish, afterward acid taste, permanent in the air. It is soluble in about 300 parts of water, in 2 parts of alcohol at $25^{\circ}C$ ($77^{\circ}F$), and in 14 parts of boiling water. The addition of 2 parts of sodium sulphite or 1 part of ammonium phosphate renders it much more soluble in water.

Test.—The addition of ferric chloride to a saturated solution produces a fine bluish violet color.

Dose.—3-60 grains (0.25-4.0 Gm.) [7.5 grains (0.5 Gm.), U. S. P.].

Official Salts.

Lithii Salicylas—Lithii Salicylatis—Lithium Salicylate (U. S. P.)—**Origin**—Obtained by heating salicylic acid, lithium carbonate, and water until effervescence ceases, filtering, and evaporating. It should not contain less than 98.5 per cent. of pure lithium salicylate ($C_6H_4(OH)COOLi$).

Description and Properties.—A white or grayish white powder, odorless, having a sweetish taste, deliquescent on exposure to air, very soluble in water and alcohol.

Dose.—5.00 grains (0.3-4.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Sodii Salicylas—Sodii Salicylatis—Sodium Salicylate (U. S. P.)—**Origin**—Prepared by acting on sodium carbonate with salicylic acid, straining, and heating the solution. It should contain not less than 99.5 per cent. of pure sodium salicylate ($C_6H_4(OH)COONa$).

Description and Properties.—A white amorphous powder, odorless, sweetish, saline taste, permanent in air, soluble in 0.8 part of water, in 5.5 parts of alcohol at $25^{\circ}C$ ($77^{\circ}F$), and in glycerine.

Dose.—5.00 grains (0.3-4.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Ammonii Salicylas—Ammonii Salicylatis—Ammonium Salicylate (U. S. P.)—**Description**—It should contain not less than 98 per cent. of pure ammonium salicylate ($C_6H_4(OH)COONH_4$).

Description and Properties.—It occurs in colorless, lustrous, monoclinic prisms or plates, or white crystalline powder, odorless and having at first a slightly saline, bitter taste, with a sweetish after-taste. Permanent in dry air. The concentrated aqueous solution reddens blue litmus. Very soluble in water (10.9 parts), slightly less so in alcohol (2.3 parts).

Dose.—Average dose 4 grains (0.250 Gm., = 250 milligrammes), U. S. P.

Physiological Action.—*Externally and Locally.*—Salicylic acid is antiseptic, parasiticide, irritant to mucous membranes; possesses the power to soften the epidermis; checks perspiration when locally applied (anhydrotic).

Internally.—Digestive System.—Small doses stimulate the stomach, larger doses act as an irritant. It retards proteolysis and also hinders fermentation, and putrefaction in the gastro-enteric canal. The biliary secretion is somewhat increased, particularly as to its solids. The liver secretory cells are in some manner stimulated.

Circulatory System.—Small doses of salicylic acid have no very appreciable effect upon the circulation. Full medicinal doses first cause the heart to beat faster and stronger, increasing arterial tension; later the arterial pressure is lowered, and excessive or toxic doses cause the pulse to become slow and labored. Its tendency ultimately, even in medicinal doses, is to depress, rather than stimulate, the heart. Its effect upon the blood is to restrain the migration of the white corpuscles.

Nervous System.—In small doses it has no cerebral action. In large doses, and in some susceptible persons in full medicinal doses, salicylic acid causes cerebral congestion, indicated by a feeling of tension in the cerebrum, headache, confusion of thought, tinnitus aurium, vertigo, and sometimes delirium. Toxic doses may occasionally produce cerebral convulsions. It lessens the reflexes, but does not affect the motor peripheral nerves. Slight analgesia may be produced.

Absorption.—Salicylic acid is converted by the gastro-intestinal secretions into the sodium salicylate, in which form it enters into the circulation.

Respiratory System.—Small doses stimulate the respiratory center and the pulmonary vagi, making the respiration quicker and deeper. Toxic doses paralyze the center and vagi, causing slow and labored respiration and death from asphyxia.

Temperature.—Febrile temperature is markedly reduced by large doses of salicylic acid. The reduction takes place usually within half an hour after a dose has been taken, and lasts several hours.

Elimination.—It increases the urinary flow as a direct parenchyma stimulant. It appears in the urine as salicyluric acid.

It is a powerful diaphoretic, large doses often causing exhausting sweating. It also increases the secretion of milk and the amount of sugar in that secretion.

Elimination takes place rapidly by all the excretories (nine minutes in the urine), but chiefly through the kidneys and skin. Traces of salicylic acid may be found for a long time after the administration of a single dose, ten to fifteen days, three days is the average. Metabolism is markedly affected, the sulphates and nitrogen in the urine going up 10 per cent. under its use. Uric acid is particularly increased. What the mechanism is is not yet determined.

Outward Action.—Erythema, urticaria, or petechiæ, accompanied by intense itching, occasionally edema of the eyelids and

lower extremities, mental depression, muscular weakness, motor disturbances, sweating, and buzzing in the ears, as mentioned under Poisoning, but to a less degree. Occasionally bleeding is seen. Abortion may be induced by its use. Prolonged administration may also produce anemia.

Poisoning.—There are roaring in the ears, deafness, intense headache, vertigo, and possibly delirium, profuse and exhausting sweating, subnormal temperature, very weak, compressible pulse, feeble and shallow respirations, dimness of vision, ptosis, and often strabismus. Albumin or blood or hemoglobin may be found in the urine. The urine and feces pass involuntarily. Death usually results from respiratory failure, but is extremely rare. 15 Gm. of sodium salicylate has caused severe symptoms, but recovery has followed.

Treatment of Poisoning.—Diffusible stimulants, atropine, strychnine—the same treatment as in poisoning by acetanilid.

Therapeutics.—*Externally and Locally*.—SALICYLIC ACID has been satisfactorily employed, in the strength of $\frac{1}{4}$ to 1 dram in 1 ounce (2-4 in 32 Gm) of petrolatum, in the treatment of *erysipelas*.

In the treatment of *chancre* salicylic acid has been extensively employed. The powdered acid should be thoroughly dusted over the surface.

The peculiar action of salicylic acid in softening and loosening thickened masses of epidermis and favoring the normal proliferation of epithelium renders the drug especially useful in the treatment of *indurated eczema*, particularly of the palm and sole, *verruca*, *tylosis*, *callositas*, *corns*, *warts*, etc.

It is one of the most useful drugs in the treatment of forms of *eczema*, *impetigo contagiosa*, *psoriasis*, *lupus*, *parasitic affections*, and in *non-parasitic syzosis*. It has been used successfully in the treatment of *acne*, *comedones*, and *pruritus*. A 1 per cent solution has been recommended in *aspergillus* of the outer auditory meatus. A wash, 3 grains to 1 ounce (0.2 to 30 Cc.) is efficient in *otorrhea*. Solutions of varying strengths are frequently useful in *acute coryza*, *diphtheria*, *inflammation of fauces*, *catarrhal stomatitis*, and to correct *offensive expectoration*, especially in *phthisis* and *gangrene of the lung*.

Internally.—There is no better example of empiricism in therapeutics than the employment of SALICYLIC ACID in *acute articular rheumatism*. Used at first in this disease to reduce temperature, it was found that while it exerted marked antipyretic action, it also lessened the pain and swelling, and in the majority of cases shortened the duration of the disease. It cannot be classed as a "specific" in any sense of the word, but merely relieves certain symptoms—fever, pain, and swelling. Other symptoms—or complications, according to some authors—such as heart affections, are uninfluenced by this medicine. It has no power to prevent either affections of the heart or relapses.

Rheumatic tetanus, iridochoroiditis, and sclerottitis are alleged to have been cured by this drug. It is useful in *gout* to relieve pain, but does not seem to influence the disease, and is of no particular value in *chronic* or *gonorrheal rheumatism, rheumatic arthritis, or rheumatic hypopyrexia.*

It is credited with being quite efficient in *chorrea* of rheumatic origin, and in relieving the pains of *herpes zoster* and *neuralgic headache.*

It is a drug to be tried in many diseases of rheumatic or neuralgic character, unless some distinct contraindication to its use exists. It surpasses any drug, with the possible exception of guaiac, in the treatment of *quinsy*, and particularly *infectious tonsillitis.* The medicine is highly regarded by competent advocates as a remedy in *diphtheria.* *Lumbago* often yields to its influence, and it has also been recommended in *sciatica*, which in the very mild cases is helped somewhat.

It is a useful antizymotic to prevent *putrefactive fermentation* and *flatulence*, and lessen thereby the tendency to *crapulous diarrhea.* It is of service in some cases of diabetes.

It has been found of use in *influenza*, and is an efficient antiseptic remedy in *chronic gastric catarrh, diarrhea, cholera, and enterocolitis.* By some eminent clinicians it is considered to be one of the most effectual remedies in *pleurisy* with effusion.

It has been recommended as an effectual anthelmintic, both for *tape-* and *round-worms.*

Contraindications.—Salicylic acid should not be given in large doses to persons who have a weak heart or are otherwise greatly debilitated, at least not without counteracting its toxic tendencies with nutrients and diffusible stimulants.

Administration.—Owing to its irritant action upon the mucous membrane, it is best given in a solution of glycerin and some aromatic water, after meals. So concentrated a form as a pill or capsule is not recommended.

Many of the untoward cerebral effects may be relieved by giving 20 grains (1.3 Gm) of sodium or potassium bromide.

If any benefit is to be derived from salicylic acid in acute articular rheumatism, it must be used early in the disease and in heroic doses at comparatively frequent intervals—not less than 20 grains (1.3 Gm) every two, three, or four hours for an adult. If too serious gastric and cerebral symptoms manifest themselves, the drug may be decreased in amount or discontinued until the unpleasant action subsides. It is better, except in acute articular rheumatism, to give a small dose, repeated frequently, than to administer a full dose at once.

The physiological action and therapeutics of LITHIUM SALICYLATE are practically the same as those of salicylic acid or sodium salicylate. It is, however, richer in salicylic acid than the sodium salt, and in *gout* and *chronic rheumatism* has been thought to be of more value than salicylic acid. It should be given in solution.

SODIUM SALICYLATE is identical in physiological action and uses with salicylic acid, with the exception that it is less irritating to the stomach, and is therefore ordinarily to be preferred to the acid.

It may be prescribed in aromatic water, in syrup, or in powder, pills, or capsules.

Phenylis Salicylas—Phenylis Salicylātis—Phenyl Salicylate. *U. S. P.*

(SALOL, *U. S. P.*, 1890.)

Origin.—The salicylic ether ($C_6H_4(OH)COOC_6H_5$, 1:2) of phenyl prepared by heating salicylic acid with phenol in the presence of phosphorus pentachloride.

Description and Properties.—A white, crystalline powder, odorless, or having a faintly aromatic odor, and almost tasteless. Permanent in the air. Almost soluble in 2333 parts of water; soluble in 15 parts of alcohol at $25^{\circ}C$ ($77^{\circ}F.$), also in 0.3 part of ether, and readily in chloroform and in fixed or volatile oils.

Dose.—3–15 grains (0.19–1.0 Gm.), [74 grains (0.5 Gm.), *U. S. P.*]

Physiological Action.—*Externally and Locally.*—It is a more powerful antiseptic than either of its constituents. Nencki claims that it is not a germicide, as it will not destroy bacteria when present, although it prevents their formation. It is not, like salicylic acid, irritating to the mucous membranes.

Internally.—It is converted by the pancreatic and intestinal juices into its original constituents—salicylic acid and carbolic acid. It is usually absorbed and eliminated very rapidly, having been detected in the urine in the form of salicyluric acid and phenol-ether-sulphuric acid within thirty minutes after its ingestion by the stomach. To the latter acid is due the dark, smoky color of the urine which sometimes exists under large or continued doses of salol.

The action of salol is essentially like that of its constituents, but it is a more powerful antipyretic, analgesic, and cerebrospinal sedative. It reduces temperature much more promptly, the antipyretic action occurring within fifteen minutes after a full medicinal dose has been taken. The effect, however, is not prolonged, repeated doses being required to maintain the reduction of temperature.

The circulation is, perhaps, not so much depressed as by salicylic acid. The respirations are at first quite rapidly increased, and are rendered very shallow, requiring some time to resume their normal condition. Large doses may cause phenol-poisoning.

Therapeutics.—*Externally and Locally.*—Salol is especially recommended as an antiseptic dressing for wounds, burns, venereal ulcers, and buboes. Powdered salol or an ointment—1 part to 150 parts of petrolatum—has been used in cases of tubercular laryngitis and ozæna. Like salicylic acid, it is also of value in eczema and sycosis simplex.

Internally.—It is an efficient remedy in all diseases benefited by the internal administration of salicylic acid. In addition to these services it is a valuable remedy in acute and chronic cystitis, gonorr-

rhea, *intestinal catarrh*, especially *duodenal catarrh* and *catarrhal jaundice*, and to relieve the pains of *neuritis* and *myalgia*.

Administration.—It may be given in pills, capsules, powders, emulsion, or suspended in milk. The compressed tablets of this drug so extensively used at present are not to be recommended, owing to their slow and difficult solution.

Allied Compounds.

The compounds of salicylic acid are extremely numerous. It is beyond the purpose of the present volume to mention them all, but the following have been employed widely and have something in their favor as remedial agents: *Aspirin*, or acetyl salicylic acid, a white powder soluble in 100 parts of water, said to be more efficient than the salicylates, and to cause less gastric irritation. *Dose*, 5–15 grains (0.3–1 Gm.), three daily. *Salutarol*, resembling salol, an acetone racetic replacing the phenyl in that compound. Used for the same purposes in doses of 30–45 grains (2–5 Gm.). *Salicylramid* is tasteless, more soluble than salicylic acid, and more active. *Dose*, 2–5 grains (0.1–0.3 Gm.). *Salicylsol*, acetanilid and salicylic acid; not reliable. *Saligenin*, a substitute for salicin in doses of 8–15 grains (0.5–1 Gm.). *Salicyrene* antipyrine and salicylic acid, has the combined effects of its constituents, and is an efficient drug in doses of 15–30 grains (1–2 Gm.). *Salophen*, resembling salol somewhat, but phenol in different form, acetyl β -amidophenol. *Dose*, 12–30 grains (1–2 Gm.).

It should be recalled that practically all of these derivatives are decomposed to salicylic acid and to sodium salicylate.

Salicinum—Salicinl—Salicin. U. S. P.

Origin.—A glycoside obtained from several species of *Salix* (willow) and *Populus* (poplar).

Description and Properties.—Colorless or white, silky, shining, crystalline needles, or a crystalline powder, odorless and having a very bitter taste. Permanent in the air. Soluble in 21 parts of water, 71 parts of alcohol at 25° C (77° F.), 0.7 part of boiling water, and in 2 parts of boiling alcohol.

Dose.—10 grains—2 drams (0.6–8 Gm.) [15 grains (1 Gm.) U. S. P.].

Physiological Action.—Its physiological effect is analogous to that of salicylic acid, but is much less active than the latter. It does not disturb digestion, but in moderate doses promotes appetite and acts like other bitters. It is more rapidly absorbed than salicylic acid, is partly decomposed, and is found in the urine, as salicin and salicylic acid, in from fifteen to thirty minutes after the ingestion of a single dose.

Therapeutics.—While inferior to salicylic acid in most respects, salicin is frequently used for the same purposes.

Administration.—Salicin may be administered in powders, capsules, or solution. Owing, however, to its bulk and intensely bitter taste, it is perhaps best given in suspension in the aromatic elixir of licorice or in syrup of yerba santa.

Öleum Gaulthēriæ—Ölei Gaulthēriæ—Oil of Wintergreen. U. S. P.

Origin.—A volatile oil distilled from the leaves of *Gaulthēria procumbens* L., a small evergreen plant indigenous in the northern hemisphere and bearing a scarlet, fleshy, berry-like fruit.

Description and Properties.—The volatile oil is a colorless or yellow, or occasionally reddish, liquid, having a characteristic strong aromatic odor, and a sweetish, warm, and aromatic taste. Specific gravity, 1.172 to 1.180 at 25° C (77° F.).

It consists almost entirely of methyl salicylate. It should be kept in well-stoppered bottles, protected from light.

Dose.—2-10 minims (0.12-0.6 Cc) (15 minims (1 Cc.), U. S. P.).

Official Preparation.

Spiritus Gaultheriæ—Spiritus Gaultheriæ—Spirit of Gaultheria (ESSENCE OF WINTERGREEN)—*Dose*, 1-2 fluidrams (4.0-8.0 Cc) (30 minims (2 Cc.), U. S. P.).

Physiological Action.—*Externally and Locally.*—Oil of wintergreen is a stimulant and a powerful antiseptic.

Internally.—Its action is identical with that of salicylic acid and its salts.

Therapeutics.—*Externally and Locally.*—Used for the same purposes as the aromatic oils, and also locally applied in the treatment of acute articular rheumatism.

Internally.—Used for the same purposes as salicylic acid.

Mēthylis Salicylas—Mēthylis Salicylātis—Methyl Salicylate. U. S. P.

Definition.—An ester ($C_6H_4(OH)OC_2H_5$, 1-3) produced synthetically. It is the principal constituent of oil of gaultheria and oil of betula.

Dose.—15 minims (1 Cc.), U. S. P.

Ōleum Betulæ—Ōlei Betulæ—Oil of Birch. U. S. P.

Definition.—A volatile oil obtained by maceration and distillation from the bark of the sweet birch, *Betula lenta* L.

Dose.—15 minims (1 Cc.), U. S. P.

Allied Compounds.

Aspirin, acetyl salicylic acid, is decomposed in salicylic acid in the intestines, and hence has no marked advantage. Its taste is less offensive and hence it can be taken by patients who have irritable stomachs. 30-45 grains (2-3 Gm.).

Mesotan is a methylxylinic ester of salicylic acid. It is a liquid and resembles oil of wintergreen without its agreeable (?) odor. It is readily absorbed by the skin and is thought to influence the joints more promptly than the oil of wintergreen. It is of value in umbago also, and may be combined with olive oil and massage in some of the more protracted arthritides. It has the same indications as the other salicylates, and taken internally is ultimately broken down into sodium salicylate.

Liquor Formaldehydi—Liquōris Formaldehydi—Solution of Formaldehyde. U. S. P.

Definition.—An aqueous solution containing not less than 37 per cent by weight of absolute formaldehyde, H_2CO .

Properties.—Formaldehyde itself is a gas at ordinary temperatures, having a very pungent odor. The various products on the market are solutions of the gas in water. They are variously known as *formalin*, *formol*, *formaldehyde*, *oxymethylen*, *methanal*, etc. Formaldehyde readily undergoes polymerization, whereby a solid form is obtained, known as paraformaldehyde, or *paraform*. When a solution of formaldehyde is evaporated by heat, and more slowly by long standing, paraformaldehyde separates as a white, flocculent, nearly odorless mass, which is almost insoluble in

water, alcohol, or ether, and which begins to sublime below 100° C. When heated, paraformaldehyde vaporizes and reforms the gaseous formaldehyde. It is sold in tablets which are employed for disinfecting purposes by vaporization.

Formaldehyde is very active chemically; it has a strong reducing action and unites with amines, forming the official odorless hexamethylenamine (urotropine). It is easily oxidized.

Several dusting powders containing formaldehyde in combination have been introduced; thus *plastol* is a compound of gelatin and formaldehyde, *amylform*, of starch and formaldehyde, etc.

Formaldehyde is a constituent of many food-preservatives, embalming preparations, etc.

Therapeutics.—Formaldehyde solutions are efficient and valuable bactericides. They are used very extensively in mouth-washes, etc. The vapor and liquid are very irritating and are not well adapted to internal medication.

Balsamum Peruviani—Balsami Peruviani— Balsam of Peru. U. S. P.

Origin.—A balsam obtained from *Tinifera Peruviana* (Koyale) Baillon, a tree growing in Brazil and near the west coast of South America.

Description and Properties.—A liquid having a syrupy consistence, free from stringency or stickiness, of a brownish black color in bulk, reddish brown and transparent in thin layers, of an agreeable, vanilla-like, somewhat smoky odor, and a bitter taste, leaving a persistent after taste. On exposure to air it does not become hard. It is completely soluble in 5 parts of alcohol.

The drug contains, among other substances, benzoic and cinnamic acid, cinnamoin about 60 per cent, and resin 32 per cent.

Dose.—8–30 minims (0.5–1.84 Cc.) (15 grains (1 Gm., U. S. P.).

Physiological Action.—Its physiological action is largely due to the aromatic acids, cinnamic, and benzoic acids contained. See Benzoin.

Therapeutics.—In various cutaneous disorders balsam of Peru is very efficient, being employed in *pruritus vulvæ*, *eczema*, *scabies*, *ringworm*, etc. It is remarkably efficacious as an application to *cracked nipples*, *cracked lips*, *indolent sores*, *bed-sores*, etc., and is also serviceable in certain diseased conditions of the nose and throat, such as *atrophic rhinitis* and *tonsillar diphtheria*.

As a stimulant expectorant the drug is efficient in *chronic bronchitis*, being regarded by some physicians as of great service in *phthisis pulmonalis*.—Like myrrh, balsam of Peru has been used to some extent as a stomachic carminative and tonic.

Administration.—It is best given in an emulsion or in glycerin.

VOLATILE OILS, RESINS, OLEORESINS, BALSAMS.

THE following-named drugs, classed by some authors as aromatics, are not only active antiseptics and antispasmodics, but possess properties very similar to those of the more typical antiseptics, antipyretics, and anesthetics. These antiseptic properties of aromatic drugs are well known to modern science, and, what is of unique interest and significance, were perfectly familiar to the ancients, who could not possibly divine the scientific value of the virtues familiarized only by the crudest empiricism. In the custom of the Egyptians of embalming the dead we have a remarkable example of their divination of antiseptics in the perfumes and spices in which their dead were buried; and in the Christian Gospel we read of Nicodemus that he "brought a mixture of myrrh and aloes," and that "they took the body of Jesus, and wound it in linen cloths with the spices, as the manner of the Jews is to bury" (John xix. 39, 40).

Aromatics owe their virtues chiefly to the volatile oils they contain, which usually possess the characteristic odor and taste of the plants from which they are derived. These volatile oils are very numerous and extremely complex in their chemical structure, yet most have certain general features in common. The most widely distributed chemical constituents are *terpenes*, hydrocarbons of the aromatic series ($C_{10}H_{16}$). Many of them contain, in addition, phenols, aldehydes, ketones, alcohols, acids, esters, lactones, and oxides—a few contain nitrogen or sulphur, in which case their action is the more complex.

The chemical investigation of many of these oils has but just begun, and it is not improbable that in the isolation and purification of some of their constituents valuable therapeutic agents may be added to the physician's armamentarium. As they agree in their physiological action, in large part at least, the general effects are here summarized in brief. It should be remembered that many of these volatile oils are very widely employed in alcoholic liquors—*crème de menthe*, *curaçoa*, *maraschino*, *absinthe*, *kummel*, *chartreuse*, etc., and therein add their effects to those of the alcohol.

General Action.—Locally, the volatile oils are stimulant and irritant. Internally, when taken in moderate quantities, they stimulate the digestive organs, and increase the activity of the circula-

tion reflexly by stimulating the sensory ends of the vagus distributed to the mucous membrane of the stomach. The impression is conveyed to the center in the medulla, and from there transmitted to the accelerator nerves of the heart. Very large doses depress the heart's action, arresting it in diastole. The poisonous action of aromatics is similar to that of irritant narcotic poisons. The different oils will vary considerably according to the predominant constituent. Thus the purer terpenes containing oils are much less poisonous; while those containing phenols, as eugenol, thymol, etc., give the characteristic picture of carbolic acid poisoning. Most of them irritate the kidneys. Many of them are quite powerful local anesthetics, particularly if rich in ketones or phenols. They first stimulate, and then depress and exhaust, the nervous system. In diseased conditions they are used to increase peristalsis, to impart tone to the stomach, and to act as antiseptics; to arrest gastric and intestinal fermentation; to relieve pain wherever they are applied; and, by increasing the circulation in the brain and improving the condition of the gastro-intestinal tract, to relieve many of the phenomena of hysteria. The chief contraindication for the internal use of these drugs is the inflammation of the stomach, intestines, and kidneys.

The volatile oils and the various preparations of the aromatics should be given diluted in some proper vehicle.

A classification of this general group is not feasible. The individual members are so complex that a purely chemical classification, based on their many constituents, would be impractical. From the purely physical standpoint they may be divided into a few broad groups, as volatile oils, resins, oleoresins, gumresins and balsams, but this offers no clue to their therapeutic applications. The definitions of these groups may be found in another place in this book. The general grouping arrangement by many of the older writers on *materia medica* commends itself as practical, and the following series will be taken up: (1) Aromatic flavoring vehicles and carminatives, including mentha, coriandrum, anthemus, matricaria, anisum, marrubium, rosa, aurantium, caryophyllus, cardamomum, cinnamomum, fenniculum, myristica, carum, and a number of others; (2) condiments: piper, capsicum, zingiber, macis, etc.; (3) stimulants to the respiratory and genito-urinary mucous membranes; (4) volatile oils used as nervous stimulants; and (5) skin irritants and counterirritants, including turpentine and its allies, mustard and cantharides.

It should be borne in mind, in view of their composition, that any or all of them may be used as antiseptics, and, further, that some members of the group may be classed in any or all of the groups mentioned. Thus capsicum is a good counterirritant, an excellent aromatic carminative, a widely employed condiment, and may be of service in the late period of a chronic cystitis; others might be instanced. Thus the classification is purely convenient—it possesses no other value.

I. AROMATIC VEHICLES AND CARMINATIVES.

Anisum—Anisi—Anise. U. S. P.

Origin.—The ripe fruit of *Pimpinella Anisum* L., a plant indigenous in Western Asia and Egypt, and extensively cultivated in Europe.

Description and Properties.—About $\frac{1}{4}$ inch (3.6 Mm.) long, ovate compressed laterally, grayish, finely pubescent, consisting of two mericarps, each with a flat face, and narrow light brownish hallow ridges, and about fifteen thin oil tubes, perceptible in transverse section by the aid of the microscope. Anise has an agreeable, aromatic odor and a sweet, spicy taste. It contains from $1\frac{1}{2}$ to 3 per cent. of a volatile oil. It resembles the fruit of the common dill, differing from it usually in being longer and more ovate, and having another odor and taste. The fruit of the common has, moreover, but a single smooth mericarp without oil tubes.

Dose.—8-30 grains (0.5-2.0 Gm.), [$7\frac{1}{2}$ grains (0.5 Gm.), U. S. P.]

Öleum Anisi—Ölei Anisi—Oil of Anise. U. S. P.

Origin.—A volatile oil distilled from anise or from the fruit of Star anise, *Illicium verum*.

Description and Properties.—A colorless or pale yellow, thin and strongly refractive liquid, having the characteristic odor of anise, and a sweetish, mildly aromatic taste, neutral in reaction. It contains a stearopten anisole, $C_{10}H_{12}O$, and a methyl chavicol, $C_{10}H_{12}O$, upon which its properties in large part depend.

Oil of anise should be kept in well-stoppered bottles, protected from light, and if it has separated into a liquid and a solid portion, it should be completely liquefied by warming before being dispensed.

Dose.—1-5 minims (0.06-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Official Preparations.

Aqua Anisi—Aque Anisi—Anise Water.—*Dose.* $\frac{1}{4}$ to 1 fluidounce (8.0-30.0 Cc.) [2 drams (16 Cc.), U. S. P.].

Spiritus Anisi—Spiritus Anisi—Spirit of Anise.—*Dose.* 1 to 2 fluidminims (4.0-8.0 Cc.) [1 dram (4 Cc.), U. S. P.].

Oil of anise is contained in the following preparations:

Spiritus Aurantii Compōsitus; Syrupus Sarsaparillæ Compōsitus; Tinctura Opii Camphorata; Trochisci Glycyrrhizæ et Opii.

Physiological Action.—Anise is slightly antiseptic, stimulant, and carminative; oil of anise is irritant if applied in full strength to mucous membranes, stimulating both the digestive and circulatory apparatus, improving the appetite, and slightly strengthening and accelerating the heart's action. In very large doses it possesses mildly narcotic properties. It is excreted in the urine, sweat, and by the bronchial mucous membrane, the secretion from which it liquefies.

Therapeutics.—Anise is employed to relieve flatulence in children, as a sedative expectorant, and as a vehicle to flavor medicines.

Cinnamōmum—Cinnamōmi—Cinnamon. U. S. P.

Origin.—There are two official varieties of cinnamon: 1, the inner bark of the shoots of *Cinnamomum zeylanicum* Presl, a tree about 30 feet high (9 M.), found in the forests of Ceylon (Ceylon cinnamon); 2, the bark of an undetermined species of *Cinnamomum* known as *Cinnamomum officinarum* (Siam cinnamon, Saigon cinnamon), from Saigon, the capital of French Cochinchina, where it is collected and exported.

Description and Properties. Most of the article brought to the United States is the cassia cinnamon. The varieties differ somewhat in appearance and are found in the shops as pieces of varying lengths, about $\frac{3}{4}$ inch 1 Mm. or more in thickness, yell-wish brown in color, externally rough (cassia), of fragrant odor, a sweet, aromatic taste, but less delicate than that of Ceylon cinnamon, which appears in large, closely rolled quills, composed of eight or more layers of bark of the thickness of paper, pale yell-wish brown, the outer surface smooth, marked with wavy lines of bast-bundles, of a very sweet, fragrant odor and a warm, aromatic, delicate taste. The Saigon cinnamon is found in the shops in large quills or broken pieces, $\frac{1}{2}$ to $\frac{3}{4}$ inch, 2 to 3 Mm. thick, the outer surface gray or light grayish brown, with whitish patches, more or less rough and warty, transversely ridged and longitudinally wrinkled, the inner surface cinnamon or dark brown, granular and slightly striate, with short and granular fracture. It has a fragrant odor, and a sweet, warmly aromatic, and somewhat astringent taste.

Constituents. All the varieties contain volatile oil, tannin, mucilage, sugar, starch, a coloring principle, and a peculiar acid.

The official oil of cinnamon is distilled from cassia cinnamon.

Dose.—5–30 grains (0.3–2.0 Gm.).

Official Preparations.

Tinctura Cardamomi Composita—Tinctura Cardamomi Composita—Compound Tincture of Cardamom.—Cardamom, 25, Saigon cinnamon, 25, capsic. waxy, 12, cochineal, 5, glycerin, 50, diluted alcohol, q. s. ad 1000 parts. *Dose*, 1–2 fluidrams (4.0–8.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Tinctura Gambir Composita—Tinctura Gambir Composita—Compound Tincture of Gambir.—Gambir, 50, Saigon cinnamon, 25, diluted alcohol, q. s. ad 1000 parts. *Dose*, $\frac{1}{2}$ –2 fluidrams (2.0–8.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Tinctura Lavandulae Composita—Tinctura Lavandulae Composita—Compound Tincture of Lavender.—Lavender, $\frac{1}{2}$ –1 fluidram (2.0–4.0 Cc.) (formula given under *Lavandula*.)

Tinctura Cinnamomi (30 per cent.)—**Tinctura Cinnamomi—Tincture of Cinnamon.**—*Dose*, $\frac{1}{2}$ –2 fluidrams (2.0–8.0 Cc.) [50 minims (2 Cc.), U. S. P.]

Pulvis Aromaticus—Pulvis Aromaticus—Aromatic Powder.—*Dose*, 10–30 grains (0.6–2.0 Gm.) (formula given under *Cardamomum*.)

Öleum Cinnamomi—Ölei Cinnamomi—Oil of Cinnamon. U. S. P.

Origin.—A volatile oil distilled from Cassia cinnamon, yielding not less than 75 per cent. by volume of anhydrous alcohol.

Description and Properties.—A yellowish or brownish liquid, becoming darker and thicker on being exposed to the air, having the characteristic odor of cinnamon and a sweetish, spicy, burning taste. Specific gravity, 1.045–1.055 at 25° C. Soluble in an equal volume of alcohol, the solution being slightly n. t. to litmus paper; also soluble in an equal volume of glacial acetic acid. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Constituents. Oil of cinnamon contains variable quantities of hydrocarbons, but consists chiefly of *cinnamyl alcohol*, $C_9H_7CH_2CHO$, and when cut or exposed to the air for a considerable time cinnamaldehyde and resin are formed. Cinnamon oil crystallizes in shining, colorless, odorless prisms, freely soluble in alcohol, ether, and boiling water. A heated lime and hot dilute nitric acid oxidize it into oil of bitter almond and benzoic acid.

Dose.—1–5 minims (0.05–0.3 Cc.).

Official Preparations.

Aqua Cinnamomi (0.2 per cent.)—**Aqua Cinnamomi—Cinnamon Water.**—*Dose*, 1–10 fluidrams (15.0–150.0 Cc.) [1 dram (16 Cc.), U. S. P.]

Spiritus Cinnamomi (10 per cent.)—**Spiritus Cinnamomi—Spirit of Cinnamon.**—*Dose*, 5–20 fluidrams (0.3–1.2 Cc.) [30 minims (3 Cc.), U. S. P.]

Cinnaldehydum—Cinnäldehÿdi—Cinnamic Aldehyde. U. S. P.

Definition.—An aldehyde, $C_9H_7CH:CHCOH$, obtained from oil of cinnamon or prepared synthetically. It is the chief and essential constituent of oil of cinnamon, and should be present to the extent of about 75 per cent. by volume in a good oil.

Description and Properties.—A colorless liquid, having a cinnamon-like odor and a burning, aromatic taste. It may be used for nearly all purposes in place of the official oil of cinnamon. Pure synthetic cinnamic aldehyde occurs in the market, and has to a great extent displaced the natural oil of cinnamon. Sparingly soluble in water, readily in alcohol, fixed and volatile oils.

Dose.—Average dose, 1 minim (0.05 Cc.), U. S. P.

Physiological Action.—Cinnamon is an agreeable aromatic stimulant, carminative, stomachic, astringent, hemostatic, and antiseptic. The oil possesses germicidal properties. It has a marked action on the vasomotor system, causing flushing and stimulating peristalsis. In poisonous doses its action approximates that of phenol.

Therapeutics.—The same as for other aromatics. It is much used to impart an agreeable flavor to medicinal compounds and as an adjuvant to other members of this group.

Coriāndrum—Coriāndri—Coriander. U. S. P.

Origin.—The dried fruit of *Coriandrum sativum* L., an annual herb about 2 feet (60.0 Cm.) high, indigenous in China and on the northeastern shore of the Mediterranean. Cultivated in Asia, Europe, and America.

Description and Properties.—Globular, about $\frac{3}{8}$ inch (3 Mm.) in diameter, slightly pointed at the apex and crowned with the calyx teeth at the base. The two concave mericarps cohere, enclosing a lenticular cavity, each furnished on the face with two oil tubes, odor and taste agreeably fragrant and aromatic.

Constituents.—Coriander contains nearly $\frac{1}{2}$ of 1 per cent. of volatile oil, 13 per cent. of fatty matter, mucilage, and traces of tannin.

Dose.—8–30 grains (0.5–2.0 Gm.) [$7\frac{1}{2}$ grains (0.5 Gm.)], U. S. P.]

Öleum Coriāndri—Ölei Coriāndri—Oil of Coriander. U. S. P.

Origin.—A volatile oil distilled from coriander.

Description and Properties.—A colorless or slightly yellowish liquid, having the characteristic aromatic odor of coriander and a warm, spicy taste. It is one of the most stable of the volatile oils. Coriandrol, $(C_{10}H_{16}O)$, an alcohol, is its most characteristic ingredient.

Dose.—1–15 minims (0.06–0.3 Cc.) [3 minims (0.2 Cc.)], U. S. P.]

Physiological Action and Therapeutics.—The same as those of the other volatile oils. Frequently used as a corrective to purgative medicines.

Fœniculum—Fœniculi—Fennel. U. S. P.

Origin.—The dried, nearly ripe fruit of *Fœniculum vulgare* Miller, a herbaceous annual or perennial, indigenous in Southern Europe and cultivated in Germany, France, and the United States.

Description and Properties.—Elong, nearly cylindrical, slightly curved, from $\frac{1}{8}$ to $\frac{1}{2}$ inch (4–12 Mm.) long, brownish or greenish brown, readily separable

into the two prominent mericarps, each with five light brown, obtuse ribs, with four oil tubes on the back and two or four upon the flat face; odor and taste aromatic, anise-like.

Constituents—Fennel contains from 2 to 4 per cent of *volatile oil*, which is almost identical chemically with that of anise, 12.5 per cent of fixed oil, and sugar.

Dose.—8-30 grains (0.5-2.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Official Preparations.

Confectio Sennæ—Confectio Sennæ—Confection of Senna (0.5 per cent).—*Dose*, 1-2 drams (4.0-8.0 Gm.) [60 grains (4 Gm.), U. S. P.] (Formula given under *Senna*.)

Infusum Sennæ Compositum—Infusi Sennæ Compositi—Compound Infusion of Senna.—*Dose*, 1-2 fluidounces (30.0-60.0 Cc.) [4 drams (120 Cc.), U. S. P.] (Formula given under *Senna*.)

Öleum Fœniculi—Ölei Fœniculi—Oil of Fennel.

U. S. P.

Origin—A volatile oil distilled from fennel.

Description and Properties—A colorless or pale yellowish liquid, having the characteristic aromatic odor of fennel and a sweetish, mild, and spicy taste. Soluble in an equal volume of alcohol. It should be kept in well-stoppered bottles, in a cool place, and if it has partly or wholly solidified, it should be completely liquefied by warming before being dispensed.

Constituents—It has constituents similar to those of the oil of anise.

Dose.—1-5 minims (0.05-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Official Preparations.

Aqua Fœniculi (0.2 per cent).—**Aque Fœniculi—Fennel Water**.—*Dose*, $\frac{1}{2}$ -1 fluidounce (8.0-30.0 Cc.) [4 drams (16 Cc.), U. S. P.]

Pulvis Glycyrrhizæ Compositus—Pulveris Glycyrrhizæ Compositi—Compound Liqueur Powder.—*Dose*, 1-2 drams (2.0-8.0 Gm.) [60 grains (4 Gm.), U. S. P.] (Formula given under *Senna*.)

Spiritus Juniperi Compositus—Spiritus Juniperi Compositi—Compound Spirit of Juniper (10.5 per cent).—*Dose*, 2-4 fluidounces (80-150 Cc.). (Formula given under *Carum*.)

Physiological Action and Therapeutics are similar to those of anise.

Cārum—Cāri—Caraway. U. S. P.

Origin—The dried fruit of *Carum Carvi* L., a biennial plant native to Central and Western Asia. It is cultivated in Europe and in the United States.

Description and Properties—Oblong, laterally compressed, about $\frac{1}{8}$ to $\frac{1}{4}$ inch (4-5 Mm.) in length, tapering somewhat at the ends, brown, with five very distinct ribs and six oil tubes. Caraway has an agreeable odor and a sweetish, spicy taste.

Constituents.—It contains from 5 to 7 per cent of a volatile oil.

Dose.—15-30 grains (1.0-2.0 Gm.) [25 grains (1.6 Gm.), U. S. P.]

Official Preparation.

Tinctura Cardamomi Composita—Tincturæ Cardamomi Compositæ—Compound Tincture of Cardamom.—*Dose*, 1-2 fluidounces (4.0-80 Cc.) [1 dram (4 Cc.), U. S. P.] (Formula given under *Cardamomum*.)

Öleum Cāri—Ölei Cāri—Oil of Caraway. U. S. P.

Origin.—A volatile oil distilled from caraway.

Description and Properties.—A colorless or pale yellow, thin liquid, having the characteristic aromatic odor of caraway and a mild, spicy taste. Soluble in an equal volume of alcohol, this solution being neutral to litmus paper.

By fractional distillation the oil may be separated into two portions: a light hydrocarbon with but little odor and taste, *carisone*, and a ketone having an agreeable caraway odor, *carione* ($C_{10}H_{16}O$).

Dose.—1-10 minims (0.6-0.66 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Official Preparation.

Spiritus Juniperi Compōsitus—Spiritus Juniperi Compōsiti—Compound Spirit of Juniper.—Oil of Juniper, 8; oil of caraway, 1; oil of fennel, 1; alcohol, 1400; water, q. s. ad 2000 parts. **Dose,** 2-4 fluidrams (8.0-15.0 Cc.) [2 drams (8 Cc.), U. S. P.].

Physiological Action and Therapeutics.—The same as those of the other aromatic oils.

Mýrrha—Mýrrhæ—Myrrh. U. S. P.

Origin.—A gum-resin obtained from *Commiphora Myrrha* (Nees) Engler, a shrub or small tree "forming the chief underwood of the Arabian and African forests along the shores of the Red Sea."

Description and Properties.—Roundish, irregular tears or masses, dusty brownish yellow or reddish-brown; fracture waxy, somewhat splintery, translucent on the edges, sometimes marked with whitish veins; odor balsamic; taste aromatic, bitter, and acrid. It is a dried up emulsion like juice. It contains 60 per cent of gum, 35 per cent of resin, and 3 to 4 per cent of a volatile oil of unknown composition, thought by Flückiger to contain carvone. It is now thought that there is no carvone in this oil.

Dose.—5-30 grains (0.3-2.0 Gm.), in pills or emulsion [7½ grains (0.5 Gm.), U. S. P.].

Official Preparations.

Mistūra Fērrī Compōsita—Mistūræ Fērrī Compōsitæ—Compound Iron Mixture.—**Dose,** ½-2 fluidounces (15-60 Cc.) [4 drams (16 Cc.), U. S. P.].

Pillulæ Aloes et Mýrrhæ—Pillulæ (acc.) Aloes et Mýrrhæ—Pills of Aloes and Myrrh.—**Dose,** 2-5 pills [2 pills, U. S. P.].

Tinctūra Aloes et Mýrrhæ—Tinctūræ Aloes et Mýrrhæ—Tincture of Aloes and Myrrh (10 per cent).—**Dose,** ½-2 fluidrams (2-8 Cc.) [30 minims (2 Cc.), U. S. P.].

Tinctūra Mýrrhæ—Tinctūræ—Mýrrhæ Tincture of Myrrh (20 per cent).—**Dose,** 15-60 minims (1-4 Cc.) [15 minims (1 Cc.), U. S. P.].

Physiological Action.—Myrrh is astringent, disinfectant, slightly antiseptic, and stimulant. Its action resembles that of the aromatics, stimulating the appetite and acting as a carminative, excessive doses causing nausea and vomiting.

The drug is eliminated by the mucous membranes generally, augmenting and disinfecting their secretions. It possesses emmenagogue properties.

Therapeutics.—As a stimulant and astringent myrrh is serviceable as a mouth-wash in *pyhalism* and *spongy gums* and in *ozena*. It is useful as a gargle in *pharyngitis*, *relaxed throat*, etc., and as an injection in *leukorrhea*, the latter disease, as well as *cystitis*, being favorably influenced by the internal administration of the drug. It

has been used internally, with considerable success, as a stimulant expectorant in *bronchorrhoea* and *chronic bronchitis*, and as a stomachic in *atonic dyspepsia*.

Administration.—Myrrh may be given internally in the form of an emulsion or pills. The tincture, either in full strength or diluted, is chiefly employed externally.

Eucalÿptus—Eucalÿpti—Eucalyptus. U. S. P.

Origin.—The dried leaves of *Eucalyptus globulus* Labillardiere, collected from the older part of the tree. The *blue gum tree* is a rapid grower, attaining a height of 200 to 300 feet (60-90 M). It is native to Australia, but is cultivated in various portions of Europe, Africa, and the United States with the view of rendering malarial districts habitable by its antiseptic exhalations. Its efficacy in this direction is due solely to its using large quantities of water for its growth, thereby depriving the malarial bearing mosquitoes of the marshy grounds in which they develop their larvae.

Description and Properties.—Petiolate, lanceolate, scythe-shaped, from 6 to 12 inches (15-30 cm) long, rounded below, tapering above, entire, leathery, grayish green, glandular, feather veined between the midrib and marginal veins, odor strongly camphoraceous; taste pungently aromatic and somewhat cooling, bitter, and astringent.

The most important constituent is a *volatile oil*, of which the leaves yield about 6 per cent.

Dose.— $\frac{1}{2}$ -2 drams (2.0-3.0 Gm) [30 grains (2 Gm), U. S. P.].

Official Preparation.

Fluidextractum Eucalÿpti—Fluidextracti Eucalÿpti—Fluidextract of Eucalyptus.—*Dose*, 5-60 minims (0.3-4.0 Cc.) [30 minims (2.0 Cc.), U. S. P.]

Öleum Eucalÿpti—Ölei Eucalÿpti—Oil of Eucalyptus. U. S. P.

Origin.—A volatile oil distilled from the fresh leaves of *Eucalyptus globulus* Labillardiere and from other sources.

Description and Properties.—A colorless or faintly yellowish liquid, having a characteristic, aromatic, somewhat camphoraceous odor and a pungent, spicy, and cooling taste. Soluble in all proportions in alcohol. This oil consists of a mixture of hydrocarbons, the most striking of which is *eucalyptol*, probably identical with *incol*, $C_{15}H_{26}O$, one of the most widely distributed of the oxides of the hydrocarbons. It should be kept in well stoppered bottle, in a cool place, protected from light.

Dose.—5-15 minims (0.3-1.0 Cc.) [8 minims (0.5 Cc.), U. S. P.].

Eucalÿptol—Eucalÿptolis—Eucalyptol. U. S. P.

Definition.—An organic oxide (cineol) obtained from the volatile oil of *Eucalyptus globulus* and from other sources. It is also found in a great many other volatile oils, oil of capyput being one of those most widely known.

Description and Properties.—A colorless liquid, having a characteristic, aromatic, and distinctly camphoraceous odor and a pungent, spicy, and cooling taste. Soluble in all proportions in alcohol.

Dose.—5-10 minims (0.3-0.6 Cc.) [5 minims (0.3 Cc.), U. S. P.].

Physiological Action.—*Externally and Locally.*—Locally applied, the oil of eucalyptus and *eucalyptol* are more or less irritant, though perhaps less active than many volatile oils. They do not differ in any particular regard from others of this class. The resemblances of eucalyptus to quinine are largely fanciful.

Therapeutics.—Eucalyptus is a valuable remedy in chronic inflammation of mucous membranes, especially in atrophic rhinitis, where it is best applied in spray combined with a liquor petroleum excipient in the proportion of 30–60 minims (2–4 Cc. to the ounce—33 Gm.).

It has proved of service in acute and chronic skin diseases, notably simple dermatitis, and in chronic forms of eczema and psoriasis. As others of the turpentine series, it is a stimulant to sluggish ulcers.

The chief value of this drug lies perhaps in its effects upon the urine in its elimination. It is an active antiseptic and is useful in cystitis and pyelitis.

As a stimulant expectorant eucalyptus is of great value, equaling, if not being superior to, any other remedy in *bronchorrhea*, *pulmonary gangrene*, and *fetid bronchitis*, associated or not with phthisis. Chronic or catarrhal conditions of the lungs and bronchi only are benefited by eucalyptus, acute affections of the broncho-pulmonary mucous membrane contraindicating its use. A solution of oil of eucalyptus is used as an antiseptic inhalation in *diphtheria*.

Administration.—The fresh leaves may be employed as poultices. Any of the preparations may be used, but for internal purposes the oil, or eucalyptol, is preferable, although a good fluid extract is an agreeable form of the medicine. The oil, or eucalyptol, may be given in an emulsion or in capsules, for topical use being diluted with alcohol or oil or incorporated in suppositories or ointments.

Öleum Cajupūti—Ölei Cajupūti—Oil of Cajuput.

U. S. P.

Origin.—A volatile oil distilled from the fresh leaves and twigs of *Melaleuca leucadendron* L., a tree with crooked stem and scattered branches, resembling the weeping willow, indigenous in the East Indies. It should yield not less than 55 per cent. by volume of cineol.

Description and Properties.—A light, thin, bluish green, or, after rectification, colorless liquid, having a peculiar, agreeable and distinctly camphoraceous odor, and an aromatic, bitterish taste. Specific gravity, 0.025 at 25° C. With an equal volume of alcohol it affords a clear solution, which either has a slightly acid reaction or, in the case of the rectified oil, is neutral to litmus paper.

Constituents.—The chief constituent is cineol.

Dose.—1–5 minims (0.06–0.3 Cc.) {8 minims (0.5 Cc.), U. S. P.}

Physiological Action and Therapeutics are identical with those of the oil of cloves.

Cardamōmum—Cardamōmi—Cardamom. U. S. P.

Origin.—The dried, nearly ripe fruit of *Elettaria repens* (Donnerat) Bailon, a perennial plant 6 to 10 feet (1.8–3.0 M.) high.

Cardamom is indigenous in Hindustan, in the mountainous regions of Malabar.

The same plant furnishes three varieties of cardamoms, known in commerce as the *short*, *green*, and *long*.

Description and Properties.—Ovoid or oblong, from $\frac{3}{8}$ to $\frac{1}{2}$ inch (12 Mm.–2 Cm.) long, obtusely triangular, rounded at the base, beaked, longitudinally striate;

of a pale buff color, three-celled, with a thin, leathery, nearly tasteless pericarp and a central plicenta. The seeds are about $\frac{1}{8}$ inch (5 Mm.) long and $\frac{1}{8}$ inch (3 Mm.) broad, reddish brown, angular, rugose, depressed at the hilum, surrounded by a thin membranous aril-like. They have an agreeable odor and a pungent, aromatic taste.

Dose.—5-15 grains (0.3-1.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Official Preparations.

Tinctura Cardamomi (20 per cent.)—**Tinctura Cardamomi**—Tincture of Cardamom. **Dose**, 1-2 fluidrams (4.0-8.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Tinctura Cardamomi Composita—**Tinctura Cardamomi Composita**—Compound Tincture of Cardamom. Cardamom, 25, Saigon cinnamon, 25, caraway, 12, cochineal, 5; glycerin, 50, dilute alcohol, q. s. ad 1000 parts. **Dose**, 1-2 fluidrams (4.0-8.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Pulvis Aromaticus—**Pulvis Aromaticus**—Aromatic Powder. Saigon cinnamon, 35; ginger, 35; cardamom, 15, nutmeg, 15. **Dose**, 10-30 grains (0.6-2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

There is also a fluidextract, *fluidextractum aromaticum*, made from this powder. **Dose**, 10-30 minims (0.6-2.0 Cc.) [15 minims (1 Cc.), U. S. P.]

Antagonists and Incompatibles.—Free acids are incompatible with the compound tincture of cardamom, separating insoluble carminic acid in it.

Physiological Action.—In this respect cardamom conforms to the general character of the Aromatic Group.

Therapeutics.—Essentially the same as for other members of this group. Cardamom is used principally as an adjuvant to other aromatics, stimulants, stomachics, and carminatives.

Calamus—Cālami—Calamus. U. S. P.

(SWEET FLAG.)

Origin.—The uprooted, dried rhizome of *Acorus Calamus* L., a plant indigenous in North America, Europe, and Western Asia, growing in swamps and along the shores of streams and ponds.

Description and Properties.—Calamus is found in subcylindrical sections of various lengths, about 1 inch (2 Cm.) broad, externally reddish-brown, internally whitish, of a spongy texture, breaking with a short, corky fracture, showing numerous oil cells and scattered wood bundles. It has a strong aromatic, fragrant odor and a warm, peculiar, bitterish taste. Calamus contains from 1 to 2 per cent. of volatile oil possessing the odor and taste of calamus, a glucosid (acotin) in the form of a bitter, yellow syrupy liquid, besides calanone, choline, resin, starch, and mucilage.

Dose.—15-60 grains (1.0-4.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Official Preparation.

Fluidextractum Cālami—**Fluidextracti Cālami**—Fluidextract of Calamus. **Dose**, 15-60 minims (1.0-4.0 Cc.) [30 minims (2.0 Cc.), U. S. P.]

Physiological Action and Therapeutics.—The action of calamus is similar to that of anise, but is more tonic than the latter. Large doses of the volatile oil produce tetanic convulsions.

It is used for the same purposes as anise, but probably possesses more stomachic and carminative properties.

Öleum Lavandulæ Flörum—Ölei Lavandulæ Florum—Oil of Lavender Flowers. U. S. P.

Origin.—A volatile oil distilled from fresh flowering tops of *Lavandula officinalis* hairs. Lavender is a native to Southern Europe and cultivated in gardens.

Description and Properties.—A colorless or yellowish liquid, having the fragrant odor of lavender flowers and a pungent and bitterish taste. Soluble in all proportions of alcohol. It should be kept in well stoppered bottles, in a cool place, protected from light.

Dose.—1-5 minims (0.06-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Official Preparations.

Spiritus Lavandulæ (5 per cent.)—**Spiritus Lavandulæ**—Spirit of Lavender.—**Dose**, ʒss-1 fluidram (2.0-4.0 Cc.) [30 minims (2 Cc.), U. S. P.].

Tinctura Lavandulæ Compōsita—**Tinctura Lavandulæ Compōsita**—Compound Tincture of Lavender.—Oil of lavender, 8; oil of rosemary, 2; Saigon cinnamon, 30; cloves, 5; nutmeg, 10; red sanders, 10; alcohol, water, aa q s ad 1000 parts. **Dose**, ʒss-1 fluidram (2.0-4.0 Cc.) [30 minims (2 Cc.), U. S. P.]. Compound tincture of lavender is an ingredient of liquor potassii arsenitis.

Physiological Action and Therapeutics are the same as those of other volatile oils mentioned in this group.

Mēnthā Piperitā—Mēnthæ Piperitæ—Peppermint. U. S. P.

Origin.—The dried leaves and flowering tops of *Mentha piperita* Smith, a perennial plant found in damp places in England and other European countries and in North America.

Peppermint contains about 1 per cent. of a volatile oil—its most important constituent.

Dose.—60 grains (4 Gm.), U. S. P.

Öleum Mēnthæ Piperitæ—Ölei Mēnthæ Piperitæ— Oil of Peppermint. U. S. P.

Origin.—A volatile oil distilled from the fresh or partly dried leaves and flowering tops of peppermint, yielding not less than 8 per cent. of ester, calculated as menthyl acetate, and not less than 50 per cent. of total menthol.

Description and Properties.—A colorless liquid, becoming darker and thicker by age and exposure to the air, having the characteristic strong odor of peppermint and a strongly aromatic, pungent taste, followed by a sensation of cold upon inhalation. It forms a clear solution with an equal volume of alcohol, becoming turbid when further diluted, and is soluble in all proportions in carbon disulphide and in glacial acetic acid.

When exposed to a freezing temperature the oil becomes thick and cloudy, and separates crystals of menthol, to which it owes its peculiar odor.

Dose.—1-5 minims (0.06-0.3 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Official Preparations.

Aqua Mēnthæ Piperitæ (0.2 per cent.)—**Aqua Mēnthæ Piperitæ**—Peppermint Water.—**Dose**, ʒss-1 fluidounce (15.0-30.0 Cc.) [4 drams (16 Cc.), U. S. P.].

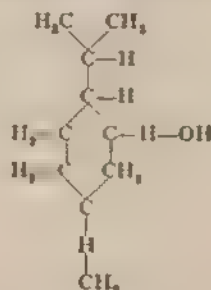
Spiritus Mēnthæ Piperitæ (10 per cent.)—**Spiritus Mēnthæ Piperitæ**—Spirit, or Essence, of Peppermint.—**Dose**, 5-60 minims (0.3-0.4 Cc.) [30 minims (2 Cc.), U. S. P.].

Spirit of peppermint is an ingredient of mistura rhei et sodæ.

Menthol—Mentholis—Menthol. U. S. P.

Definition.—A secondary alcohol, $C_{10}H_{18}(CH_3)(OH)(C_2H_5)1:3:4$, obtained from the oil of *Mentha piperita* L., or other peppermint oils.

Description and Properties.—Colorless, acicular, or prismatic crystals, having a strong and pure odor of peppermint and a warm, aromatic taste, followed by a sensation of cold when air is inhaled. Menthol is but slightly soluble in water, but imparts to the latter its odor and taste. It is freely soluble in alcohol, ether, chloroform, carbon disulphide, and glacial acetic acid. It is a saturated secondary alcohol, with the following formula:



Dose.— $\frac{1}{2}$ –2 grains (0.03–0.12 Gm.) [1 grain (0.065 Gm.), U. S. P.].

Physiological Action and Therapeutics.—*Externally and Locally.*—MENTHOL is an antiseptic, antipruritic, analgesic, and anesthetic, as well as a germicide. It is used for the same purposes as oil of cloves. It is used extensively in *headache*, being rubbed on the forehead. Owing to its analgesic properties, it is used in the form of an ointment in various strengths for painful *hemorrhoids*, *burns*, *boils*, and *superficial inflammations*.

The OIL OF PEPPERMINT, or MENTHOL, is an ingredient of many sprays and lotions for the treatment of diseases of the *ear*, *nose*, and *throat*.

As an antipruritic MENTHOL is a valuable remedy to relieve the itching of *eczema*, *pruritus*, *urticaria*, etc. It should be dissolved in oil for this purpose—in severe cases 50 grains to 1 ounce (3.2 Gm to 30.0 Cc.).

Internally.—The uses of OIL OF PEPPERMINT are similar to those of other aromatic oils, it being a valuable carminative, stimulant, antifermentative, and antispasmodic. In small doses MENTHOL has been given to allay *nausea* and *vomiting* and to relieve the pain of *gastralgia*.

Mentha Viridis—Menthæ Viridis—Spearmint. U. S. P.

Definition.—The dried leaves and flowering tops of *Mentha spicata* L.

This is one of the mints found in the same localities as peppermint, and containing, like the latter drug, a volatile oil forming its active constituent. It possesses milder properties than peppermint, although similar to it in its action and uses. To some people it has a more agreeable taste than peppermint, and in infantile cases it is usually preferred.

Official Preparations.

Aqua Menthae Viridis—**Aquæ Menthae Viridis**—**Spearmint Water.**

Spiritus Menthae Viridis—**Spiritus Menthae Viridis**—**Spirit, or Essence, of Spearmint.** *Dose*, 30 minims (2 Cc.), U. S. P.

Oleum Menthae Viridis—**Olei Menthae Viridis**—**Oil of Spearmint.**—The *dose* of the oil of spearmint and of the above preparations is the same as for the corresponding oil and preparations of peppermint.

Thymol—Thymol—Thymol. U. S. P.

Origin.—A phenol, $C_6H_3(CH_3)(OH)(C_2H_5)$ 1:3:4, occurring in the volatile oils of *Thymus vulgaris* L., and in some other volatile oils.

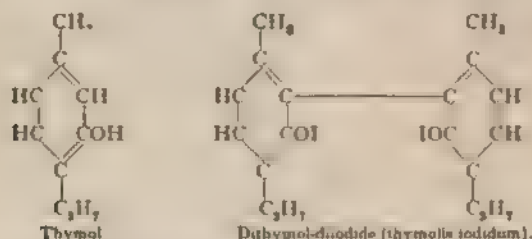
Description and Properties. Large, colorless, translucent crystals of the hexagonal system, having an aromatic, thyme like odor and a pungent, aromatic taste, with a very slight caustic effect upon the lips. Its specific gravity as a solid is 1.030, but when liquified by fusion it is lighter than water. It is soluble in about 1100 parts of water and in less than its own weight of alcohol, ether, or chloroform; also readily soluble in carbon disulphide, glacial acetic acid, and in fixed or volatile oils. When triturated with about equal quantities of camphor, menthol, or chloral, it liquefies.

Dose.—1-5 grains (0.06-0.3 Gm.) [2 grains (0.125 Gm.), U. S. P.].

Thymolis Iodidum—Thymolis Iodidi—Thymol Iodide. U. S. P.

(ARISTOL)

Definition.—Dithymol diiodide, $(C_6H_3CH_3C_2H_5OI)_2$, obtained by the condensation of two molecules of thymol (a methylisopropylphenol) and the introduction into its phenolic group of two atoms of iodine. It contains 45 per cent of iodine.



Description and Properties.—A bright, chocolate-colored or reddish-yellow, bulky powder, almost tasteless and having a slight aromatic odor. Insoluble in water and glycerin, soluble with difficulty in alcohol, readily soluble in fatty oils and in ether, vasoline, chloroform, and carbon oil.

Allied and Derived Compounds.—Many other derivatives or compounds of thymol have been suggested for therapeutic use—e. g., *thymolal* (thymol carbonate), *thymacetin* (analogous to phenacetin), *thymoform* (condensation product of thymol and formaldehyde), *iodothymoform* (iodized thymoform), mercury compound of thymol, *thymosanol*, etc.

Physiological Action.—Thymol is a powerful antiseptic, being ten times less poisonous than carbolic acid because of its slow absorption, yet as an antiseptic far superior to it. While stimulant, it is not irritant or corrosive. It is also a deodorant, disinfectant, parasiticide, and local anesthetic, as well as an antipruritic, antipretic, and antifermentative.

Absorption and Elimination.—It is eliminated chiefly by the

lungs and kidneys, producing some irritation at the points of elimination. The urine is increased in quantity, often assuming a dark-greenish hue, due to dioxybenzols.

Untoward Action.—The following symptoms have been produced by the administration of large doses: burning sensation in the mouth and stomach, persisting in some instances for days, accompanied by pain and tenderness under pressure. According to Balz, "perspiration is sometimes observed, and occasionally a transient buzzing in the ears and deafness."

Poisoning.—In addition to untoward manifestations, there may be nausea and vomiting, profuse sweating, great reduction of temperature, dizziness, violent delirium, and collapse.

Therapeutics.—*Externally and Locally.*—The applications of thymol in surgery are identical with those of carbolic acid.

Crocker in 1878 introduced it as an efficient remedy in certain skin diseases. It probably owes its value in these cases to its antipruritic and antiparasitic properties.

It is also extensively used in diseases of the nose, throat, and ear, and in certain disorders of the genito-urinary tract. Thymol is also administered by inhalation in certain broncho-pulmonary disorders.

Internally.—Thymol is used for the same purposes as other antiseptics, such as carbolic acid, resorcin, beta-naphthol, etc.

Martini highly recommends it as an intestinal antiseptic in the treatment of diarrhea, dysentery, and typhoid fever.

It has been employed with some success in limiting fermentation during a proteid diet in the treatment of diabetes. It has also been favorably recommended in phthisis, vesical catarrh, stomatitis, and diphtheria. Thymol is the most efficient anthelmintic for the hook-worm, *Uncinaria duodenale* and *Uncinaria americana*, in doses of 5-20 grains. For the action of aristol see iodine.

Administration.—It may be applied externally in solution (1:1000), as an ointment (1-10 per cent.), or in the form of thymol gauze as a surgical dressing (1 per cent. of thymol).

For internal use it should be given in pills or capsules.

II. CONDIMENT GROUP.

Capsicum—Capsici—Capsicum. U. S. P.

(CAYENNE PEPPER.)

Origin.—The dried ripe fruit of *Capsicum fastigiatum* Blume, deprived of its calyx. *Capsicum fastigiatum* is a small crooked branched shrub, 1 to 2 feet (30.0-60.0 cm) high, indigenous in tropical America and Asia, and cultivated in gardens. The fruit is an oblong conical pod from $\frac{1}{8}$ to $\frac{1}{4}$ inch (8-19 mm) long, of a crimson or yellow color. It encloses two or three cells containing flat, reniform, yellowish seeds, attached to a thick, central placenta. These pods when dried and ground form capsicum, which has a peculiar odor and an intensely hot, aromatic taste. This ground product is of a bright-red color, fading upon long exposure to the light. Capsicum of the market usually consists of several species ground together, and is often adulterated with sawdust and sometimes with red lead.

Constituents. Capsicum contains *capsicum*, an acid principle found in the greatest amount in the African product, also a volatile alkaloid, fixed and volatile oil, and fat acids.

Dose. 3-5 grains (0.2-0.3 Gm., [1 grain (0.065 Gm.), U. S. P.].

Official Preparations.

Fluidextráctum Capsici—Fluidextrácti Capsici—Fluidextract of Capsicum.—*Dose*, $\frac{1}{2}$ 2 minims (0.03-0.12 Cc.) [1 minim (0.05 Cc.), U. S. P.]

Emplástrum Capsici—Emplástrum (acc.) Capsici—Capsicum Plaster. For external use.

Oleoresina Capsici—Oleoresina Capsici—Oleoresin of Capsicum.—*Dose*, $\frac{1}{4}$ 1 minim (0.015-0.06 Cc.) [$\frac{1}{2}$ grain (0.03 Gm.), U. S. P.]

Tinctura Capsici—Tinctura Capsici—Tincture of Capsicum.—*Dose*, 5-20 minims (0.3-1.2 Cc.) [8 minims (0.5 Gm.), U. S. P.].

Physiological Action.—Externally and Locally.—Capsicum is an irritant and rubefacient, producing vesication if kept in contact with the skin for a long time. It so irritates the mucous membrane of the mouth and nose as to induce sneezing.

Internally.—Digestive System.—Capsicum is a powerful gastro-intestinal stimulant, increasing the flow from the salivary, gastric, and intestinal glands. It increases the blood-supply to, and stimulates the walls of, the stomach, occasioning a sense of heat. It is a powerful carminative. Large doses produce great irritation in the stomach and bowels.

Circulatory System.—It is a powerful stimulant to the heart, greatly increasing the strength and rapidity of its action.

Absorption and Elimination.—It is chiefly eliminated by the kidneys, increasing the flow of urine. Large doses may produce vesical tenesmus, and aphrodisiac effects have sometimes been produced.

Therapeutics.—Externally and Locally.—Owing to its counter-irritant action, capsicum is employed to relieve *lumbago*, *torticollis*, *neuralgia*, *rheumatic pains*, and *acute inflammation of the skin or mucous membrane*. An infusion or the diluted tincture is an excellent gargle in *relaxed uvula*, *pharyngitis*, and the *angina of scarlet fever*.

The tinctures of capsicum and cantharides have been used to stimulate the scalp in the various forms of *alopecia*. The tincture is frequently used as a domestic remedy for the benefit of *chilblains* and *toothache*.

Internally.—Capsicum is a most valuable stomachic in an atonic condition of the digestive organs, and a very efficient remedy in the *irritable and catarrhal conditions of the stomach* due to the excessive use of alcohol.

The tincture of capsicum or the powdered drug, added to hot water or to hot water and whisky, makes a valuable and rapid cardiac and vascular stimulant.

Contraindications.—Capsicum and its preparations should not be given in acute inflammatory affections of the gastro-intestinal and genito-urinary tracts.

Administration.—The oleoresin and the powder should be given in pills or capsules. The fluidextract and the uncture should be administered well diluted with water.

Piper—Piperis—Pepper. *U. S. P.*

(BLACK PEPPER.)

Origin.—The dried unripe fruit of *Piper nigrum* L., a knotted, pointed-branched, aromatic, climbing shrub, indigenous in India, and cultivated in many of the East Indian and Philippine and some of the West Indian islands.

Constituents.—Its important constituents are a *volatile oil* (1 to 2 per cent); a neutral principle, *piperin* (6 to 8 per cent), and a pungent, soft, dark-green *resin*, to which the acid taste and medicinal properties of pepper are due.

Dose.—5-30 grains (0.3-1.2 Gm.) [7½ grains (0.5 Gm.), *U. S. P.*].

Official Preparations.

Oleoresina Piperis—Oleoresinæ Piperis—Oleoresin of Pepper.—*Dose*, ¼-1 grain (0.015-0.06 Gm.) [½ grain (0.03 Gm.), *U. S. P.*].

Piperinum—Piperini—Piperin.—*Origin.*—A feebly basic substance ($C_{17}H_{19}O_3 \cdot C_8H_7 \cdot CH=CH \cdot CH_2 \cdot CH_2 \cdot ON \cdot C_4H_9$) obtained from pepper, as well as from other plants of the natural order *Piperaceæ*.

Description and Properties.—Colorless or pale yellowish, shining, prismatic crystals, odorless, and almost tasteless when first taken into the mouth, but after a while producing a sharp, biting sensation. Permanent in the air, almost insoluble in water, but soluble in 15 parts of alcohol and in 1 part of boiling alcohol.

Dose.—1-10 grains (0.03-0.6 Gm.) [3 grains (0.2 Gm.), *U. S. P.*].

Derivative Compound.

Piperonal—Heliotropin.—Obtained from piperic acid by oxidation. It occurs in small white crystals, soluble in about 600 parts of cold water, and very readily soluble in alcohol and ether. The *dose* is 10-15 grains (0.6-1.0 Gm.). It has been used as an antiseptic and antipyretic.

Physiological Action and Therapeutics of pepper and its preparations are almost identical with those of capsicum.

Pepper, particularly piperin, possesses antiperiodic and antiseptic properties to a greater extent than capsicum.

Myristica—Myristicæ—Nutmeg. *U. S. P.* Macis—Macis—Mace.

Definition.—The kernel of the ripe seeds of *Myristica fragrans* Houttuyn.

Origin.—The seed (*Myristica*) and the membrane, "arilode," investing the kernel (*Macis*) of *Myristica fragrans* Houttuyn, a tree about 30 feet (9 M.) high, found in the Molucca Islands and cultivated in the East Indies.

Öleum Myristicæ—Ölei Myristicæ—Oil of Nutmeg. *U. S. P.*

Origin.—A volatile oil distilled from myristica.

Description and Properties.—A thin, colorless, or pale yellowish liquid, having the characteristic odor of nutmeg, and a warm, spicy taste. It becomes darker

and thicker by age and exposure to the air. Soluble in an equal volume of alcohol. It should be kept in well-stoppered bottles, in a cool place, protected from light. Its most important ingredients are pinene, eugenol, myristicin, and a phenol.

Dose.—1-3 minims (0.06-0.18 Cc.) [3 minims (0.2 Cc.), U. S. P.].

Physiological Action and Therapeutics are the same as those of anise.

Caryophyllus—Caryophylli—Cloves. U. S. P.

Origin.—The dried flower buds of *Eugenia aromatica* (L.) O. Kuntze, a hard wood, shrubby evergreen. It was originally found in the Molucca Islands, whence it was introduced and cultivated among the East Indian Islands.

Description and Properties.—The buds are about $\frac{1}{4}$ inch (15 Mm.) long, dark brown, consisting of a subcylindrical, solid and glandular calyx tube, terminated by four teeth and surmounted by a globular head, formed by four petals covering numerous curved stamens, and one style. A clove resembles a nail (*Latinus*. Fr. *clou*).

Cloves have a strong aromatic odor and a pungent, spicy taste, and when pressed or scratched emit oil.

Constituents.—Cloves contain about 18 per cent. of a highly pungent volatile oil, 17 per cent. of tannin, and small quantities of fixed oil, gum, resin, etc. The most important constituent of the oil is the phenol, *eugenol*, $C_{11}H_{14}O_2$, making up 70 to 85 per cent. of the oil, also a terpene, caryophyllene; methyl alcohol and furfural are present in small quantities.

Dose.—5-10 grains (0.3-0.6 Gm.) [4 grains (0.25 Gm.), U. S. P.]

Official Preparation.

Tinctura Lavandulae Composita—Tinctura Lavandulae Composita—Tincture of Lavender.—*Dose*, $\frac{1}{2}$ -1 fluidram (2.0-4.0 Cc.). (Formula given under *Lavender*.)

Öleum Caryophylli—Ölei Caryophylli—Oil of Cloves. U. S. P.

Origin.—A volatile oil distilled from cloves, yielding not less than 80 per cent. by volume of eugenol.

Description and Properties.—A pale-yellow, thin liquid, becoming darker and thicker by age and exposure to the air, having a strongly aromatic odor of cloves and a pungent, spicy taste. Its specific gravity is 1.060-1.067. Soluble in an equal volume of alcohol, the solution being slightly acid to litmus-paper.

Constituents.—Oil of cloves consists of a light and a heavy oil, the former a hydrocarbon, supposed to be inactive; the latter a phenol-like liquid termed *eugenol*, a colorless oil with the odor of cloves, a specific gravity of 1.076-1.0785, yielding with bases crystalline salts.

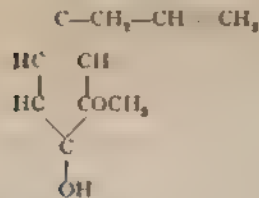
Dose.—1-10 minims (0.06-0.6 Cc.).

Eugenol—Eugenolis—Eugenol. U. S. P.

Definition.—An unsaturated, aromatic phenol, $C_6H_5(OH).OCH_3$, $C_6H_5.4 : 3 : 1$, obtained from oil of cloves and other sources.

Description and Properties.—A colorless or pale yellow, thin liquid, highly refractive, and having a strongly aromatic odor of cloves and a pungent, spicy taste. Almost insoluble in water, easily soluble in alcohol, should be soluble in 2 parts of 70 per cent. alcohol. This is the chief constituent of oil of cloves, and may be used instead of the latter; it is also the chief constituent of oil of pimenta.

Chemically it is para-oxy-meta-methoxy anil benzol, having the formula:



Dose.—Average dose, 3 minims (0.2 Cc.), U. S. P.

Allied Compounds and Derivatives.

Benzoyl-eugenol.—*Origin*—From eugenol.

Description and Properties—It occurs in neutral, odorless, colorless, acicular crystals, having a feebly bitter taste; soluble in hot alcohol, ether, and chloroform, and insoluble in water.

Dose—Not yet determined.

Cinnamyl-eugenol.—*Origin*—A derivative of eugenol.

Description and Properties—Colorless, odorless, tasteless, lustrous needles, soluble in hot alcohol, ether, and chloroform, and insoluble in water.

Eugenyl-acetamide.—*Origin*—Obtained from eugenol-acetic-ethyl-ether by treating with solution of ammonia. It occurs as a crystalline powder.

Physiological Action.—*Externally and Locally.*—OIL OF CLOVES is a counterirritant, local anesthetic, and germicide.

Internally.—Its action is essentially the same as that of anise, it being a powerful carminative and stimulant.

Therapeutics.—*Externally and Locally.*—OIL OF CLOVES is employed as a local anesthetic in *toothache*, *earache*, and *neuralgia*, and as a synergist to other counterirritants, rubefacients, and antiseptics. The EUGENOL-ACETAMIDE is a powerful local anesthetic, being analogous to cocaine in its action.

Internally.—The therapeutics are similar to those of anise. The BENZOYL-EUGENOL has been highly recommended by some practitioners as a valuable remedy in *tuberculosis*. The following combination may be employed as an antiseptic and antifermentative in *gastric fermentation*, to be administered either in soft capsules, with olive oil as a vehicle, or in the form of an emulsion:

℞ Oil carophylli,
Oil cinnamomi,
Oil menthae piperitæ,
Creosoti,

aa ℥j—M

Sig—Take ʒ one time

The better way to administer it is in the form of soft capsules, each capsule containing the above dose in about 6 minims (0.37 Cc.) of olive oil. One or two capsules should be given three times a day, after meals.

Pimenta—Pimentæ—Pimenta. U. S. P.

(ALLSPICE)

Origin.—The dried, nearly ripe fruit of *Pimenta officinalis* Lindley, an evergreen tree about 30 feet (9 M.) high, indigenous in the West Indies, Central America, and the northern part of South America.

Constituents.—The most important constituent is the *volatile oil*, of which the fruit yields from 3 to 4 per cent.

Ōleum Pimēnta—Ōlei Pimēntæ—Oil of Allspice.**U. S. P.**

Origin.—A volatile oil distilled from pimenta, yielding not less than 65 per cent. by volume of eugenol.

Description and Properties.—A colorless or pale yellow liquid, having a strong, aromatic, clove-like odor and a pungent, spicy taste. It becomes darker and thicker with age and exposure. The active ingredient of the oil is eugenol.

Dose.—1-5 minims (0.06-0.3 Cc.) [30 minims (0.3 Cc.), U. S. P.]

Physiological action and therapeutics are similar to those of cloves.

Zingiber—Zingiberis—Ginger. U. S. P.

Origin.—The dry rhizome of *Zingiber officinale* Roscoe, a perennial herb indigenous to tropical Asia and now cultivated in most tropical countries.

Description and Properties.—A thick, flattish rhizome from 1 to 4 inches (25 to 100 Mm.) long, with club-shaped lobes on one side, deprived of the corky layer, pale, buff colored, striate, breaking with a mealy, rather fibrous fracture, showing numerous small, scattered resin-cells and fibro-vascular bundles, the latter enclosed by a mucous sheath. Agreeably aromatic and of a warm, pungent taste.

Ginger contains about 0.75 to 2 per cent. of a pale yellow volatile oil of uncertain composition, to which the ginger owes its aromatic properties, also a soft resin, giving to the drug its hot, pungent taste. The proportion of resin present varies with the different varieties of ginger, that from the East Indies yielding about 8 per cent., while the Jamaica product yields only about 5 per cent.

Dose.—8-30 grains (0.5-2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Official Preparations.

Fluidextractum Zingiberis—Fluidextracti Zingiberis—Fluidextract of Ginger. *Dose*, 10-30 minims (0.6-2.0 Cc.) [15 minims (1 Cc.), U. S. P.]

Oleoresina Zingiberis—Oleoresinæ Zingiberis—Oleoresin of Ginger. *Dose*, 1-3 grains (0.06-0.15 Gm.) [$\frac{1}{2}$ grain (0.03 Gm.), U. S. P.]

Pulvis Aromaticus—Pulveris Aromatici—Aromatic Powder. *Dose*, 10-30 grains (0.6-2.0 Gm.) (Formula given under *Cardamomum*.)

Pulvis Rhæi Compōsitus—Pulveris Rhæi Compōsiti—Compound Powder of Rhubarb.—Rhubarb, 25; magnesia, 65; ginger, 10 parts. *Dose*, $\frac{1}{2}$ -1 dram (2.0-4.0 Gm.) [30 grains (2 Gm.), U. S. P.]

Syrupus Zingiberis—Syrupi Zingiberis—Syrup of Ginger. *Dose*, $\frac{1}{2}$ -2 drams (2.0-8.0 Cc.) [4 drams (16 Cc.), U. S. P.]

Tinctura Zingiberis—Tincturæ Zingiberis—Tincture of Ginger (20 per cent.)—*Dose*, $\frac{1}{2}$ -2 fluidrams (2.0-8.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Physiological action and therapeutics are almost identical with those of other aromatics. Ginger is especially valuable as a stomachic and carminative, to stimulate the stomach, improve the appetite, and relieve flatulency and colic. It is a safe and efficient domestic remedy for the relief of simple diarrhea. It is also much used as a corrective to modify the taste and action of other medicines.

III. AROMATICS USED FOR THEIR SUPPOSED ANTI-SPASMODIC ACTION ON THE NERVOUS SYSTEM.

Asafœtida—Asafœtidæ—Asafetida. U. S. P.

Origin.—A gum resin obtained from the root of *Ferula fetida* (Bunge) Regel, and probably other species of *Ferula*, large perennial herbs found in Turkestan, Western Tibet, and Western Afghanistan.

Description and Properties.—Irregular masses composed of whitish tears embedded in a yellowish or brownish-gray, sticky mass. The tears when hard break with a conchoidal fracture, showing a milk white color, which changes, on exposure, to pink, and finally to brown. The drug has a persistent alliaceous odor and a bitter, alliaceous, acrid taste. When triturated with water it yields a milk white emulsion, which becomes yellow upon the addition of ammonia water. It is partly soluble in ether, and at least 60 per cent. of it should dissolve in alcohol.

Dose.—5-8 grains (0.3-0.5 Gm.) [4 grains (2.5 Gm.), U. S. P.].

Official Preparations.

Emulsio Asafœtidæ—Emulsi Asafœtidæ—Emulsion of Asafetida. *Dose*, 2-4 fluidrams (7.3-15.0 Cc.) [4 fluidrams (120 Cc.), U. S. P.]

Pilule Asafœtidæ—Pilulæ (acc.) Asafœtidæ—Pills of Asafetida.—*Dose*, 2 to 5 pills.

Tinctura Asafœtidæ—Tinctura Asafœtidæ—Tincture of Asafetida (20 per cent.).—*Dose*, 10-40 minims (0.6-2.5 Cc.) [15 minims (1 Cc.), U. S. P.].

Camphōra—Camphoræ—Camphor. U. S. P.

Definition.—The dextrogyrate modification of the saturated ketone, $C_{15}H_{11}CO$, obtained from *Cinnamomum camphora* (L.) Nees et Ebermeyer, and purified by sublimation.

The camphor laurel is a handsome tree, 25 to 30 feet (7.5-9 M.) high, indigenous in Eastern and Southeastern Asia, and cultivated in Italy as an ornamental tree.

Description and Properties.—White, translucent masses, of a tough consistence and crystalline structure, readily pulverizable in the presence of a little alcohol, ether, or chloroform, having a penetrating, characteristic odor and a pungently aromatic taste. Very sparingly soluble in water, but readily soluble in alcohol, ether, chloroform, carbon disulphide, benzoin, and in fixed and volatile oils.

When camphor is triturated in about molecular proportions with menthol, phenol, or ethereal hydrate, liquefaction ensues. It melts at $175^{\circ}C$ ($347^{\circ}F$), boils at $204^{\circ}C$ ($399.2^{\circ}F$), and is inflammable, burning with a luminous, smoky flame. On exposure to the air it evaporates more or less rapidly at ordinary temperatures, and when moderately heated it sublimates without leaving a residue.

From camphor may be obtained a number of interesting compounds, such as *camphoric acid*, *cymol*, etc. The drug should be kept in well-closed vessels, in a cool place.

Dose.—2-10 grains (0.12-0.6 Gm.).

Official Preparations.

Æqua Camphoræ—Æquæ Camphoræ—Camphor Water (0.8 per cent.).—*Dose*, 1/2-2 fluidounces (15-50 Cc.) [2 fluidrams (6 Cc.), U. S. P.]

Linimentum Camphoræ—Linimentū Camphoræ—Camphor Liniment.—Camphor, 20; cottonseed oil, 80 parts. For external use.

Linimentum Saponis—Linimentū Saponis—Soap Liniment (4-5 per cent.).—For external use.

Spiritus Camphoræ—Spiritus Camphoræ—Spirit of Camphor (10 per cent.).—*Dose*, 5-40 minims (2.3-2.9 Cc.) [15 minims (1 Cc.), U. S. P.]

Tinctura Opii Camphorata—Tinctura Opii Camphorata—Camphorated

Tincture of Opium (0.4 per cent.).—*Dose*, 1-4 fluidrams (4-15 Cc.) [2 fluidrams (8 Cc.), U. S. P.]

Camphōra Monobromāta—**Camphōræ Monobromātæ**—**Monobromated Camphor** (U. S. P.)—*Definition*—A substitution compound of camphor, $C_{15}H_{11}BrO$.

Origin—Prepared by heating camphor and bromine, dissolving in benzoin, and crystallizing from hot alcohol.

Description and Properties—Colorless, prismatic needles or scales, of a mild, camphoraceous odor and taste, permanent in the air, unaffected by light, and neutral to litmus-paper. Almost insoluble in water; freely soluble in alcohol, ether, chloroform, hot benzoin, and fixed and volatile oils; slightly soluble in glycerin.

Dose.—2-5 grains (0.12-0.3 Gm.) [2 grains (0.125 Gm.), U. S. P.]

Acidum Camphoricum—**Acidi Camphorici**—**Camphoric Acid** (U. S. P.)—*Definition*—A dibasic organic acid, $C_{15}H_{16}(COOH)_2$, obtained by the oxidation of camphor.

Origin—Obtained by the oxidation of camphor through the action of nitric acid.

Description and Properties—White, acicular crystals, odorless, and of a weak, acid, and slightly astringent taste. Soluble in hot water, alcohol, ether, and fatty oils, almost insoluble in cold water.

Dose.—10-30 grains (0.6-2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Valeriāna—Valeriānæ—Valerian. U. S. P.

Origin—The dried rhizome and roots of *Valeriana officinalis* L., an herbaceous perennial 2 to 3 feet (0.6-1.2 M.) high, a native of Europe, and cultivated to some extent in New England and New York.

Description and Properties.—The rhizome varies in length between $\frac{1}{2}$ and 1 $\frac{1}{2}$ inches (1-3 Cm.), and has nearly an equal diameter, thick, upright, anglobular or obconical, truncate at both ends, brown or yellowish brown, internally whitish or pale brownish, with a narrow circle of white wood under the thin bark. Roots numerous, slender, brittle, brown, with a thick bark and slender, ligneous cord. Odor peculiar, becoming stronger and unpleasant on keeping; taste camphoraceous and somewhat bitter.

Valerian contains valerianic and other acids and a volatile oil.

Dose.—15-60 grains (1.0-4.0 Gm.) [30 grains (2 Gm.), U. S. P.]

Official Preparations.

Fluidextrāctum Valeriānæ—**Fluidextrācti Valeriānæ**—**Fluidextract of Valerian**.—*Dose*, 15-60 minims (1.0-4.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Tinctūra Valeriānæ—**Tinctūræ Valeriānæ**—**Tincture of Valerian** (20 per cent.).—*Dose*, 1-2 fluidrams (4.0-8.0 Cc.) [1 fluidram (4 Cc.), U. S. P.]

Tinctūra Valeriānæ Ammoniāta—**Tinctūræ Valeriānæ Ammoniātæ**—**Ammoniated Tincture of Valerian** (20 per cent.).—*Dose*, 30-60 minims (2.0-4.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Ammoniā Valēras—**Ammoni Valerātis**—**Ammonium Valerate** (U. S. P.)—*Definition*—It should contain not less than 98 per cent. of pure ammonium valerate, $C_{15}H_{16}(COONH_4)_2$.

Origin—Obtained by saturating valerianic acid with gaseous ammonia and crystallizing.

Description and Properties.—Colorless or white quadrangular plates, emitting the odor of valerianic acid, of a salty and sweetish taste, deliquescent in moist air. Very soluble in water and in alcohol. Ammonium valerianate should be kept in well-stoppered bottles.

Dose.—2-10 grains (0.12-0.6 Gm.) [7 $\frac{1}{2}$ grains (5 Gm.), U. S. P.]

Zinci Valēras—**Zinci Valerātis**—**Zinc Valerate** (U. S. P.)—*Definition*—It should contain not less than 99 per cent. of pure zinc valerate, $C_{15}H_{16}(COO)_2Zn + 2H_2O$.

Origin—Obtained by evaporating hot solutions of zinc sulphate and sodium valerianate, the zinc valerate crystallizing out.

Description and Properties.—White, pearly scales, having the odor of valerianic acid and a sweetish, astringent, and metallic taste. On exposure to air it slowly loses valerianic acid. Soluble in about 100 parts of water and in 40 parts of alcohol. It should be kept in small, well-stoppered bottles.

Dose.— $\frac{1}{2}$ -3 grains (0.03-0.2 Gm.) [2 grains (1.25 Gm.), U. S. P.]

Physiological Action.—*Externally and Locally.*—The only member of this group having any special local action is CAMPHOR. This drug has an anesthetic effect upon the unbroken skin, but in a concentrated state is very irritating to mucous membranes, and may even produce inflammation and sloughing. CAMPHOR is also a powerful parasiticide.

Digestive System.—In medicinal doses antispasmodics stimulate the digestion and augment the secretions from the gastro-intestinal tract. They also stimulate peristalsis, and are active carminatives and calmatives to the digestive tract. ASAFETIDA is the most laxative of all.

Large doses of any antispasmodic cause nausea, vomiting, and purging, CAMPHOR being the most irritant, and in toxic doses acting as an irritant poison.

Circulatory System.—In medicinal doses the antispasmodics increase the force of the heart and elevate arterial tension.

Nervous System.—It is probably upon the nervous system that these drugs exert their most potent action. They are all stimulants to the cerebrum.

The antispasmodics, it will be seen, appear to exert a calmative influence upon certain nerve-centers, allaying nervous excitement and muscular spasm. They produce a gentle, exhilarating effect upon the brain, and diffuse a feeling of warmth in the system. It is claimed that they also possess mildly aphrodisiac properties. Excessive doses, on the other hand, may occasion delirium, even merging in maniacal excitement, this being particularly true of CAMPHOR, toxic doses of which drug, in the monobromated form, cause muscular weakness, passing into paralysis, followed by stupor and collapse. VALERIAN may occasion formication of the hands and feet and a condition of mental depression.

Respiratory System.—The antispasmodics are all respiratory stimulants and stimulant expectorants. Large doses of MONOBROMATED CAMPHOR depress respiration.

Absorption and Elimination.—These drugs are readily absorbed from the stomach or rectum, and are eliminated by the intestinal tract, kidneys, lungs, skin, and mucous membranes generally, stimulating the glands in these structures, and, in the case of ASAFETIDA and VALERIAN, imparting the characteristic odor of these drugs to the excretions.

Temperature.—Unaffected except by MONOBROMATED CAMPHOR, which in large doses acts as a depressant.

Uterus.—The menstrual flow and sexual appetite are increased at first; continued dosage, however, has a depressing effect upon the generative functions, CAMPHOR perhaps being the most active in large doses.

ASAFETIDA exerts the greatest influence on menstruation, while CAMPHOR has the most marked effect upon the general circulation.

It is said that the sexual passion of cats is extraordinarily excited by valenan, probably because of its odor.

Untoward Action.—CAMPHOR may occasion mental confusion, headache, vertigo, dryness of the mouth and thirst, flushing of the face, clammy perspiration, disturbances of digestion, and strangury. Musk produces similar untoward manifestations, with a sense of pressure in the eye-sockets and marked sexual excitement. The symptoms caused by VALERIAN are very much the same, although, as in the untoward action of ASAFETIDA, there is more disturbance of the gastro-intestinal tract, such as nausea, borborygmi, diarrhea, and colicky pains. Barbier noted visual hallucinations in a person treated with VALERIAN.

Poisoning.—The symptoms of poisoning resemble the untoward action, save that the effects may be more marked, with greater irritation of the intestinal tract and more pronounced cerebral disturbance.

Treatment of Poisoning.—Coffee and the arterial sedatives antagonize the action of CAMPHOR. The patient should be treated symptomatically; emetics or the stomach-pump should be employed, and measures taken to favor elimination. Excessive nervous manifestations may be controlled by opium or the bromides.

Therapeutics.—Externally and Locally.—The only member of the present group used locally is CAMPHOR, its anesthetic and antipruritic properties rendering it of great value in the treatment of diseases of the skin. "Anderson's powder," composed of pulverized camphor, starch, and zinc oxide, is a very soothing and efficient dusting-powder in *erythema*, *erythematous eczema*, and *urticaria*. "Camphor-ice" and ointments of camphor, alone or combined with salicylic acid, are used for "*chapped hands*," *ulcers*, etc.

Various inhalants and powders containing camphor have been successfully employed in the treatment of *ozena*, *acute coryza*, and *laryngitis*. SUPPOSITORIES OF CAMPHOR afford great relief in cases of *chorda*, while the CAMPHOR LINIMENT is a household remedy for *sprains*, *bruises*, *chilblains*, etc.

CAMPHOR CHLORAL makes an efficient local application in *neuralgia*, and the CAMPHO-PHENIQUE is an excellent antiseptic, when mixed with oil being an efficient dressing for *wounds*.

Internally.—The disagreeable odor and taste of many of the antispasmodics—notably asafetida, valerian, and musk—greatly limit their use. ASAFETIDA is an exceedingly valuable stomachic tonic, and singularly beneficial in the *atonic dyspepsia* and *constipation* of nervous and anemic women. It stimulates the appetite and digestion, acts as a laxative, and allays much of the nervousness and depression from which these patients so frequently suffer.

ASAFETIDA is a peculiarly potent remedy in relieving *paroxysms of hysteria* and there is probably no more effective agent for the alleviation of *flatulent colic* of infants and various *infantile convulsions*. It is here given in *enemata*.

Chronic bronchitis and *bronchorrhea*, especially when attended with spasmodic dyspnea, are very favorably influenced by this remedy. Its antispasmodic action renders asafetida of considerable

value in *whooping-cough* and the *sympathetic cough of mothers*. The drug has been highly recommended in *chorea* occurring in young girls about the age of puberty, who are weak, anemic, and suffering from menstrual irregularities. The emulsion of *asafetida*, used as an enema, often affords prompt and complete relief in the *tympanitis of typhoid fever*.

CAMPHOR is a remarkably efficient anodyne, antispasmodic, and carminative in *flatulent colic*, *diarrhea of infants*, and the *diarrhea of the aged* produced by relaxation of the bowels. For many years camphor has been considered a valuable remedy in the *diarrhea* ushering in an attack of *Asiatic cholera*.

The various spasmodic and hysteric disorders for which *asafetida* is recommended are also greatly benefited by camphor. It is, moreover, a serviceable stimulant expectorant and a potent remedy, especially MONOBROMATED CAMPHOR, to allay *sexual excitement* and for the relief of *chordee*. It has likewise proved efficacious in *spermatorrhea*.

Dysmenorrhea and the *after-pains of labor* are greatly relieved by camphor, either alone or combined, with morphine. The drug has been used extensively as a cardiac stimulant and to allay the delirium and restlessness of *typhoid*, *typhus*, and *exanthematous fevers*.

CAMPHORIC ACID is an efficient remedy in checking the *night-sweats of phthisis* and *excessive perspiration in acute rheumatism*. It is recommended by Wood in *enuresis* and *spermatorrhea*. While not so efficient as camphor or monobromated camphor in spasmodic and hysteric disorders, it has proved of some benefit in these conditions.

Camphoric acid in from 1 to 2 per cent. solution is useful in the treatment of *acute pharyngitis* and *acute coryza*, being employed in the form of a gargle or spray.

Camphoric acid has been used internally to acidify ammoniacal urine in *cystitis*.

VALERIAN has been employed for the same class of disorders as those treated with *asafetida*, but seems to be superior to the latter in mitigating the *hysteric manifestations* and *vasomotor disturbances* occurring at the *menopause*.

The *hypochondriasis of feeble and morbidly sensitive girls and women* is occasionally relieved by this remedy. *Nervous headache* and *vertigo* are often promptly relieved by valerian or the ammonium valerate.

Valerian has been favorably recommended in both *diabetes insipidus* and *diabetes mellitus*.

Contraindications.—There are no special contraindications to the use of antispasmodics other than in acute inflammations of the gastro-intestinal tract, when camphor should not be employed.

Administration.—Any of the preparations of the various members of this group may be used. *Asafetida* and camphor in substance should always be given in the form of pills or capsules. Camphoric acid is best administered in capsules.

ANTIPYRETICS AND ANTIPYRETIC ANALGESICS.

In the attempt to make an artificial quinine when it was pointed out that that alkaloid was a derivative of quinoline, a host of new bodies which have become of immense importance in modern therapeutics, has been brought into existence. A number of these bodies will be discussed in this chapter, and for purposes of convenience they have been grouped as follows: I. Quinolene derivatives, with the general formula C_9H_7N . Quinine, euquinine, analgene, kairoline, thalline, cupreine, quinaphthol. II. Pyrrol derivatives, C_4H_5N , C_5H_7N , antipyrine, tolypyrine, tolysal, anilipyrine, pyramidon, and other antipyrine relatives. III. Hydrazine derivatives: phenylhydrazine, pyrodine, antithermine; and IV. Aniline derivatives: aniline, acetanilid, exalgine, euphorine, thermidine, neurodine, phenetidine, phenacetine, triphenine, lactophenine, citrophene or, apolysine, malakine, phenosal, cosapine, phesin, phenocol, eupyrene, pyrantine, etc.

The chemical relations of these will be pointed out later. It is of importance to remember that, although a large number of substances are here printed, many of them have no real excuse for being. Thus, in the first group, the quinolines proper, quinine is practically the only one worth mentioning, and in the second group antipyrine is the only member of real importance.

As for the hydrazines they are not a trustworthy series of drugs. They depress temperature very markedly, it is true, but they do so at the expense of a profound hemolytic action in the blood.

Concerning the aniline groups, it contains many important drugs, principally acetanilid and phenacetine, but there are many others of marked therapeutic value. This group falls naturally into

two series. In the one are derivatives of phenylamine, $N \begin{smallmatrix} \diagup H \\ - H \end{smallmatrix} C_6H_5$,

or ammonias in which one hydrogen is replaced by the phenyl radicle. In *acetanilid* another hydrogen is replaced by the acetyl

group, or $N \begin{smallmatrix} H \\ - C_6H_5 \end{smallmatrix} C_2H_3O$, and in *exalgine* the third hydrogen is replaced

by a methyl group $N \begin{smallmatrix} CH_3 \\ - C_6H_5 \end{smallmatrix} C_2H_3O$. The second series in this aniline

group is termed the phenetidines, they are compounds of para-

amido phenol, $C_6H_4 \begin{smallmatrix} OH \\ NH_2 \end{smallmatrix}$, in which a hydroxyl in the dioxybenzozol nucleus is replaced by an amido group. If an acetyl group is introduced in the hydrogen of the hydroxyl, $C_6H_4 \begin{smallmatrix} OC_2H_5O \\ NH_2 \end{smallmatrix}$, phenetidim is the result, if an ethyl and an acetyl group are introduced, $C_6H_4 \begin{smallmatrix} OC_2H_5 \\ NHC_2H_5O \end{smallmatrix}$, phenacetine is produced, while a methyl instead of the ethyl gives $C_6H_4 \begin{smallmatrix} OCH_3 \\ NHC_2H_5O \end{smallmatrix}$, methacetin. Other substitutions are numerous in these bodies, but these are the most fundamental.

The anilines possess to a certain extent the same drawbacks as the hydrazines, they are destructive to the blood, but usually only in larger doses. Only continued experience will teach which are the most to be trusted.

I. QUINOLIN GROUP.

Cinchōna—Cinchōnæ—Cinchona. U. S. P.

Definition.—The dried bark of *Cinchona ledgeriana* Moench, *Cinchona Calisaya* Weddell, *Cinchona officinalis* L., and of hybrids of these with other species of *Cinchona*. It should yield not less than 5 per cent. of total anhydrous cinchona alkaloids, and at least 4 per cent. of anhydrous ether-soluble alkaloids.

Origin.—The genus *Cinchona* as at present constituted consists of from thirty one to thirty six species, all of which are native to South America. The habitat of the three follows the eastern slope of the Andes, beginning in Bolivia and extending through Peru. From about 2° south latitude in Ecuador it occupies also the eastern slope of the Western Cordilleras, until by two narrow belts it enters the highlands of New Granada, whence it spreads northeast and northward into Venezuela, reaching the vicinity of Caracas and the Caribbean Sea. Owing to the great number of hybrids the delimitation of the various species of cinchona is, at the present time, almost an impossible task.

The climate in which the most valuable species are found is, according to Karsten (1858), characterized by a rainy season lasting for nine months, heavy rains falling principally during the night, alternating with sunshine and fog during the day. During the remaining three months of the year the nightly temperature frequently sinks below freezing point, in the day time, however, reaching 25° C. (77° F.) producing dense fogs.

The Cinchonas are evergreen trees or shrubs, the most valuable species attaining a height of from 40 to 80 feet (12 to 24 M.). They are not met with in the valleys, but are found at altitudes varying from 330 feet (100 M.) to 11,500 feet (3500 M.). According to Weddell, the most valuable species grow at an altitude of 4300 to 7000 feet (1300 to 2300 M.). All the species are found in the primeval forests, either singly or in collections of a few specimens. The tree is cultivated in British Guiana, Ceylon, Java, and Jamaica. It is also cultivated in South America, its original home.

Description and Properties. In quills or in curved pieces, varying in length, and usually $\frac{1}{4}$ or $\frac{1}{2}$ inch (2 or 3 Mm.) or sometimes $\frac{1}{2}$ inch (5 Mm.) thick; the outer surface covered with a gray or brownish-gray cork, usually slightly wrinkled, marked with transverse and also interesting longitudinal fissures. *C. Calisaya*, and sometimes with wattered wrists and slight longitudinal ridges. Inner surface light cinnamon-brown, very highly striate. Fracture of the outer layer short and granular, flakey fibrous in the inner layer; powder light- or yellowish-brown; odor slight, somewhat aromatic, taste bitter and somewhat astringent.

Cinchōna Rūbra—Cinchōnæ Rūbræ—Red Cinchona. U. S. P.

Origin.—The dried bark of *Cinchona imrayuba* Pavon, and of its hybrids containing not less than 5 per cent. of anhydrous cinchona alkaloids.

Description and Properties.—In quills or in curved pieces, varying in length, and from $\frac{1}{2}$, $1\frac{1}{2}$ or 3 inch (2 to 3 or 5 Mm.) thick; the outer surface covered with a grayish brown cork, more or less rough from warts and longitudinal warty ridges, and few, mostly short, transverse fissures, inner surface more or less deep reddish brown and distinctly striate, fracture short fibrous in the inner layer; powder reddish brown, odor slight, taste bitter and astringent.

Among the various alkaloids found in cinchona the following are the most important: *Quinine*, *gouanine*, *cinchonine*, and *cinchonidine*, the medicinal value of the bark depending almost exclusively upon the alkaloid *quinine*.

Other less important ingredients are lactic and kinic acids, kinowin, cinchotannic acid, cinchona red, and a minute quantity of a butyaceous, volatile oil. The ash amounts to between 1 and 2 per cent., consisting chiefly of the carbonates of calcium and potassium.

Dose of powdered cinchona, 15–60 grains (1.0–4.0 Gm.) [3 grains (1 Gm.) U. S. P.]

Official Preparations of Cinchona.

Fluidextractum Cinchōnæ—Fluidextracti Cinchōnæ—Fluidextract of Cinchona.—*Dose*, 10–60 minims (0.6–4.0 Cc.) [15 minims (1 Cc.) U. S. P.]

Tinctūra Cinchōnæ—Tincturæ Cinchōnæ—Tincture of Cinchona (20 per cent.)—*Dose*, 1–2 fluidrams (4.0–8.0 Cc.) [1 fluidram (4 Cc.) U. S. P.]

Official Preparation of Cinchona Rubra.

Tinctūra Cinchōnæ Compōsita—Tincturæ Cinchōnæ Compōsitæ—Compound Tincture of Cinchona.—10 per cent. with bitter orange peel 8 per cent., and serpentaria 2 per cent.;—*Dose*, 1–4 fluidrams (4.0–15.0 Cc.) [1 dram (4 Cc.) U. S. P.]

Official Alkaloids and Salts.

Cinchonidinæ Sulphas—Cinchonidinæ Sulphātis—Cinchonidine Sulphate.—*Description and Properties.*—White, silky, acicular crystals, without odor, and having a very bitter taste, slightly efflorescent on exposure to air. Soluble in 63 parts of water and in 72 parts of alcohol at 25° C.

Dose, 10–30 grains (0.6–2.0 Gm.) [4 grains (0.25 Gm.) U. S. P.]

Cinchoninæ Sulphas—Cinchoninæ Sulphātis—Cinchonine Sulphate.—*Description and Properties.*—Hard, white, acicular, prismatic crystals, without odor and of a very bitter taste, permanent in the air, soluble in 38 parts of water and in 10 parts of alcohol at 25° C.

Dose, 5–30 grains (0.3–2.0 Gm.) [1 grain (25 Gm.) U. S. P.]

Quinina—Quinina—Quinine.—*Description and Properties.*—A white, flaky, more or less crystalline powder, odorless, and having a very bitter taste, permanent in the air, soluble in 1750 parts of water and in 0.6 part of alcohol at 25° C. Quinine should be kept in well stoppered bottles, in a dark place.

Dose, 1–60 grains (0.06–1.0 Gm.) [4 grains (0.25 Gm.) U. S. P.]

Quinina Bisulphas—Quinina Bisulphātis—Quinine Bisulphate.—*Description and Properties.*—Colorless, transparent, or whitish orthorhombic crystals or small needles, odorless and having a very bitter taste, efflorescent on exposure to the air. Soluble in 84 parts of water and in 18 parts of alcohol at 25° C. It should be kept in well stoppered bottles, in a dark place.

Dose, 1–15 grains (0.06–1.0 Gm.) [4 grains (0.25 Gm.) U. S. P.]

Quinina Hydrobromidum—Quinina Hydrobromidi—Quinine Hydrobromide.—*Description and Properties.*—White, light, silky needles, odorless and of a very bitter taste. The salt is liable to lose water on exposure to warm or dry air. Soluble in 40 parts of water and in 0.7 part of alcohol at 25° C. It should be kept in well stoppered bottles, in a dark place.

Dose, 1–20 grains (0.06–1.3 Gm.) [4 grains (0.25 Gm.) U. S. P.]

Quininae Hydrochlōridum—Quininae Hydrochloridi—Quinine Hydrochloride.—*Description and Properties.*—White, silky, light and fine needle-shaped crystals, colorless, and having a very bitter taste. The salt is liable to lose water on exposure to warm air. Soluble in 18 parts of water and in 0.6 part of alcohol at 25° C. Quinine hydrochloride should be kept in well stoppered bottles, in a dark place.

Dose.—1-15 grains (0.06-1.0 Gm.) {4 grains (0.25 Gm.) U. S. P.}

Quininae Sulphas—Quininae Sulphatis—Quinine Sulphate.—*Description and Properties.*—White, silky, light, and fine needle-shaped crystals, fragile and somewhat flexible making a very light and easily compressible mass, lustrous from superficial efflorescence after being for some time exposed to the air, odorless and having a persistent, very bitter taste. The salt is liable to lose water on exposure to warm air, to absorb moisture in damp air, and to become colored by exposure to light. Soluble in 720 parts of water and in 86 parts of alcohol, also in 30 parts of glycerin and in about 400 parts of chloroform, and freely soluble in dilute acids at 25° C. It should be kept in well stoppered bottles, in a dark place.

Dose.—1-60 grains (0.06-1.0 Gm.) {4 grains (0.25 Gm.) U. S. P.}

Quininae Salicylas—Quininae Salicylatis—Quinine Salicylate (U. S. P.).—*Description.*—The salicylate, $21H_{21}N_3O_7(C_7H_5O_2 + H_2O)$, of the alkaloid quinine.

Description and Properties.—Colorless needles, permanent in air, but acquiring a pinkish tinge after a time. Soluble in cold water (1:77, somewhat more so in warm (1:35), in alcohol (1:11), and in glycerin (1:26) at 25° C.

It contains 68.79 per cent. quinine (the bisulphate contains 59.3 per cent. quinine, the hydrobromide 70.6 per cent., the hydrochloride 81.8 per cent., the sulphate 74.3 per cent.). The bisulphate is soluble in 8.5 parts of water, the hydrobromide in 40 parts, the hydrochloride in 18 parts, the sulphate in 720 parts. The official alkaloid (containing 3 molecules of water) is soluble in 1550 parts of water.

Dose.—Average dose: 4 grains (0.250 Gm. = 250 milligrammes), U. S. P.

Unofficial Alkaloids, Salts, and Other Quinolines.

Chinoidinum—Chinoidini—Chinoldine.—*Origin.*—Obtained from the mother liquor in the preparation of quinine sulphate, cinchonine, and the other alkaloids of cinchona.

Description and Properties.—Chinoidine is a mass, of a more or less deep brown or black color and a resin-like appearance. It has but a slight taste, being faintly bitter on mastication. Almost insoluble in water; freely soluble in acids.

Dose.—3-30 grains (0.2-2.0 Gm.).

Cinchonidinae Salicylas—Cinchonidinae Salicylatis—Cinchonidine Salicylate.—*Dose.*—2-10 grains (0.12-0.6 Gm.).

Cinchonina Iodosulphas—Cinchoninae Iodosulphatis—Cinchonine Iodosulphate.—*Antidote.*—1-50 per cent. of cocaine. *Description and Properties.*—A light powder of a reddish-brown color, insoluble in water, but soluble in alcohol. Used principally as a sedative for the circulation.

Chinolin—Chinolin—Chinolin (Quinolin).—*Origin.*—Prepared from cinchonine or quinine by distillation, or obtained synthetically.

Description and Properties.—A colorless liquid, with an aromatic, pungent odor, slightly soluble in water, freely soluble in alcohols.

Quinine itself was at one time used as a substitute for quinine to reduce temperature, but it induces collapse and has been discarded.

Antipyretic action.—The vacuivaminoliquid, is occasionally used. It is broken down into benzoic acid, quinine and an orange-colored azo-derivative, thus staining the urine red. It is of some service in acute articular rheumatism in doses of 15-30 grains (1-2 Gm.).

Dose.—3-10 milligrammes (15-6 Grs.).

Chinolin Tartras—Chinolin Tartratis—Chinolin Tartrate. Soluble in 70 or 80 parts of water. *Dose.*—5-15 grains (0.3-1 Gm.).

Quinetum—Quineti—Quinetum.—A mixture of the alkaloids precipitated by an alkali. *Dose.*—1-60 grains (0.06-4.0 Gm.).

Quininae Hydrochlōras Carbamidāta—Quininae Hydrochlōratis Carbamidāta.—Soluble salt of quinine and urea. Soluble in water. *Dose.*—1-10 grains (0.06-0.6 Gm.). It is also employed as a sedative.

Kaïne ($C_7H_7(C_2H_5N + C_2H_5)$) and Thalline ($C_7H_7(C_2H_5NH)$) were at one

time extensively used as antipyretics and analgesics, but they have been found very depressing, and after the initial fall in temperature it has been found to rise again.

Equinine, an ethyl carbonate of quinine, has an action precisely similar to that of quinine as it breaks down into that body. It has no advantages, save those of taste and more ready solubility.

The name *cinchona* given to Peruvian bark was accorded in honor of the countess of Chinchon, cured of tertian fever by the use of the drug, as early as the seventeenth century, the Spanish conquerors of the country having discerned the curative properties of the plant which scientific investigation has rendered invaluable as a therapeutic agent.

About the middle of the seventeenth century a large quantity of the bark received from America reawakened a discussion, and finally a council of Jesuits held at Rome approved a distribution of the drug—called therefrom "*Jesuits' bark*." It quickly found its way to other parts of the Continent and to England; yet still the opposition to its use was pronounced, and it was only when an English quack doctor succeeded in effecting cures among persons of rank by an employment of the drug that its services became general in malarial and typhoid fevers, as well as in various other diseases.

The discovery of the active principles of *cinchona*, crudely established by Duncan in 1803, was perfected by Pelletier and Caventou in 1820 by the preparations of quinine and cinchonine. In 1833 quinine became partially known, being completely isolated as an active principle in 1852, quinine and cinchonine having been employed since 1820-21.

Until the researches of Marchiafava, Celli, Laveran, Golgi, and others had disclosed the true etiology of malaria, quinine was used empirically in malarial diseases, its precise action being unknown. Its efficacy is now ascertained to be due to its power of destroying the plasmodia of malaria. In addition to this action, which renders the drug of the greatest value in malarial diseases, quinine possesses many other important properties, which are here considered.

Antagonists and Incompatibles.—Agents promoting waste—such as the salts of mercury, iodine, copper, zinc, lead—are therapeutically antagonistic to *cinchona*. The cerebral effects of quinine are antagonized by morphine, while atropine opposes its action upon the nervous and circulatory systems, as well as its antipyretic powers.

The incompatibles are free tannic acid, alkalies and alkaline earths, and iodine. Fowler's solution is incompatible with infusion and decoction of *cinchona*.

Synergists.—All agents promoting constructive metamorphosis. The antipyretic action of quinine is enhanced by the antipyretics, many of the aromatics and antiseptics. Its antiperiodic action is aided by arsenic, phenol, creosote, and many of the aromatics.

Physiological Action.—*Externally and Locally*—The drug is a

mild germicide, preventing putrefaction and fermentation by its destructive influence upon fungi and infusoria, a solution of 1 : 250 being sufficient for this purpose, while 1 : 500 is fatal to certain micro-organisms, and even so weak a solution as 1 : 1000 suffices to destroy some infusoria.

Quinine is essentially a protoplasm-poison. It affects lower animals and plants, interferes, when present, with the normal processes of reproduction, affects the blood-cells, and, moreover, has a peculiar action in diminishing the activity of many of the unorganized ferments.

Upon the unbroken skin it has little effect, other than to produce occasionally a slight roughening of the surface. To raw surfaces, however, and to mucous membranes it is irritant.

Internally.—Digestive System.—Its action resembles that of vegetable bitters, augmenting the secretions from the salivary and gastro-intestinal glands, stimulating peristalsis, and increasing the blood-supply to the stomach. Under moderate doses, therefore, the appetite and digestion are improved. Large dosage disturbs digestion, occasioning nausea, with, possibly, vomiting and diarrhea. The acidity of the stomach is said to be increased by quinine sulphate.

Circulatory System.—Small doses increase the force and frequency of the heart's action, excessive doses slowing and weakening it, and, frequently in children, causing an intermittent pulse. Toxic doses paralyze the heart, arresting it in diastole. It is uncertain whether or not these effects are due to an exclusive action on the cardiac muscle. It is evident, though, that small doses elevate, and large doses depress, arterial tension.

Quinine in a remarkable manner affects the constituents of the blood. The ameboid movements of the white blood-corpuscles are arrested, preventing their migration through the capillary walls in inflammation, while their number is diminished by full doses of the drug both in health and in inflammatory conditions. The red corpuscles are relatively increased in number, at least in proportion to the white corpuscles, the size of the former being diminished in febrile conditions.

Quinine retards or impairs all the oxidizing powers of the body, and materially lessens the oxygen-carrying capacity of the red corpuscles. This is shown in the diminished metabolism of the body.

Nervous System.—Small doses stimulate the cerebrum. Large doses occasion cerebral congestion, with a sensation of dizziness, fulness in the head, and other symptoms described at length under "Cinchonism."

In mammals there is a transient stimulation of the spinal cord, followed by a depression. In lower animals, notably the frog, there is a primary increase in the reflex irritability, which subsequently is followed by depression, perhaps an index of the action of the drug on the protoplasm of the ganglionic cells. Muscular

action is profoundly altered, quinine acting as a poison. Its action on sensory and motor nerves is not marked, and depressing effects on muscular contraction, formerly attributed to its action on the terminal end-plates of the motor nerves, have, of late years, been attributed to its action upon the muscle protoplasm itself.

Respiratory System.—Quinine exerts but little influence upon the respiration, small doses slightly increasing and large doses depressing the respiratory movements; death being due to respiratory paralysis, at least in the lower animals. Such paralysis is usually accompanied by paralysis of the heart and vagus. When toxic doses of quinine are thrown directly into the circulation, paralysis of the heart may be primary.

Absorption and Elimination.—The drug is quite rapidly absorbed from the alimentary canal. While its presence may be detected in the urine within fifteen minutes after the ingestion of a full dose, many hours, or even days, may elapse before the drug is finally excreted.

Some of the drug undergoes a change in the system, especially in the liver, and it may be detected in the urine as quinine and various isomeric modifications of it. While chiefly eliminated by the kidneys, it may escape from the system by other channels, having been found in the milk, sweat, saliva, tears, bile, and in dropsical effusions. Fully 90 per cent. has been recovered in the urine.

The excretion of uric acid, urea, and other nitrogenous material is considerably diminished under the use of quinine. Products by oxidation other than those derived from the nitrogenous elements are not markedly affected, hence it is probable that quinine only hinders the breaking down of proteids.

Temperature.—In health the temperature is unaffected by quinine, but in febrile conditions, particularly in malarial fever, the drug acts as a powerful antipyretic. Its antipyretic action is due, in all probability, to its action on the tissues directly. It also causes diaphoresis. Its action in malaria is naturally as a parasiticide. Many clinicians believe that it is destructive to bacteria as well as protozoa.

Etc.—There have been recorded several cases of amblyopia and of quinine amaurosis, with transitory blindness, color-blindness, wide dilatation of pupil—irresponsive to light, but responding to accommodation effort—pallor of the optic disks, with extreme diminution of both retinal veins and arteries and contraction of the visual field.

Quinine amaurosis, however, is probably very rare, but a limited number of cases being recorded, although Rogers believes that "incomplete ocular cinchonism" is of quite frequent occurrence.

Uterus.—After the inception of labor quinine seems frequently to stimulate the uterine contractions. It also increases a scanty menstrual flow. There appears to be no authoritative evidence that quinine is an abortifacient.

Untoward Action.—Besides the symptoms of cinchonism from which some persons suffer after the ingestion of a small dose, there are often occasioned various eruptions of the skin, often accompanied by marked pruritus, the eruption produced by the drug at times strongly resembling scarlatina.

Peculiar disturbances of vision and impaired hearing not infrequently attend the administration of quinine. Many patients cannot take it because of the incessant buzzing it causes. There have been recorded cases of renal and vesical irritation, varying in intensity, following the use of the drug. The administration of the salts of quinine in pill form is often followed by gastro-intestinal catarrh. The drug has also been known to occasion epistaxis and hemoptysis.

Poisoning.—Excessive doses of quinine produce a series of symptoms collectively termed *cinchonism*. They are—a feeling of fulness in the head, ringing or buzzing in the ears, varying degrees of deafness, headache, with possibly delirium, disturbances of vision, vertigo, and muscular weakness. In severe poisoning there is nausea and vomiting, swelling of the mucous membrane, bleeding from the nose, may be from the lungs, eruptions, albumin, and blood in the urine, with somnolence, coma, small rapid pulse, respiratory failure, and death. The lethal dose is difficult to determine. 1 to 2 Gm. have been fatal in children; doses of 30 Gm. have been taken without serious inconvenience.

Treatment of Poisoning.—Potassium bromide and hydrobromic acid are the best agents to relieve the symptoms of cinchonism, full doses of the latter given with quinine being said to prevent untoward results.

Should the dose be sufficient to depress the heart and respiration in a marked degree, cardiac and respiratory stimulants would be indicated.

Thorapeutics.—*Externally and Locally*.—Powdered cinchona bark is an ingredient of many tooth-powders. Quinine also enters into the composition of many "hair tonics," and is highly recommended by some physicians in the treatment of *alopecia*.

The drug has been employed with varying success in many diseases of the nose and throat, such as *hay fever*, *whooping-cough*, *ozena*, *tonsillitis*, etc.

Ledetsch has highly recommended quinine bisulphate, 1 part to 100 parts of water and glycerin, as an injection in *gonorrhea*. The drug has been used with tincture of ferri chloride as a paint to prevent the spread of *crissipelas*. A 2 per cent solution has proved an efficient remedy in *cystitis*, effectually preventing the decomposition of the urine.

Internally.—Undoubtedly the principal use of quinine is in the treatment of *malarial diseases*. When we realize that quinine in 1 part to 20,000 is sometimes destructive of the plasmodium malarie, it is readily understood why the drug should be so efficient as an antimalarial remedy.

Quinine is one of the most powerful agents in the treatment of malarial fevers, and has more or less value in many diseased conditions characterized by periodical exacerbations. All forms of malaria respond to the proper use of quinine. It seems to be a prophylactic.

From a practical point of view it is important to note that at certain phases of development the resistance to the action of quinine is increased. In the early stages of the parasite's development within the red blood cell, the resistance to quinine is very low. In the later stages, which are free, swimming in the blood, the resistance is high. The best results are obtained from quinine given during the stage of fever or in the period of decline. Early doses of quinine check the development of the parasite and prevent, in part at least, the relapse. The practical point to be gained from this is that quinine given in the period preceding the attack of fever is most effective in the cure of the disease. As it takes from two to four days to clear the plasma, this amount of time must be allowed. A dose of from 10 to 15 grains, given at the onset of the chill which is thought to record the presence of the parasite in the red blood-cells.

Many periodical affections due to malarial parasites are peculiarly amenable to this treatment, as being various *neuralgias*, *headache*, *asthenia*, *diarrhea*, *dysentery*, etc.

It is particularly beneficial in cases such as *pulmonary phthisis*, *fistulous ulcers*, *puerperal fever*, etc. It favors the resolution of acute inflammations, as in the *bronchitis*, *pneumonia*, *pleurisy*, etc.

As a tonic or restorative during the period of convalescence, quinine acts upon the gastro-intestinal tract rendering it more active. In cases of *dyspepsia*, especially the atonic variety, if anemia is present, the drug may be given with iron and nuxvomica.

Quinine is but little used now as a pyretic influence is consequently more readily obtained. It is of value also in *typhoid*, but less so as a general tonic.

It is of decided value in the *typhoid*, *sarcina ventriculi*, and equally beneficial in *ecthyma*, when occasioned by malnutrition, are greatly benefited by its use.

Quinine is serviceable in stimulating the system during labor and increasing the menstrual flow.

Contraindications.—The drug is

inflammations of the genito-urinary and gastro-intestinal tract, in acute or subacute inflammations of the middle ear, and in meningitis and cerebritis. It should not be given to infants suffering from eczema, nor to persons having a marked idiosyncrasy against the drug.

Administration.—Because of its intensely bitter and disagreeable taste quinine should not be given in solution. It may be suspended in syrup of yerba santa or in the aromatic elixir of licorice, which disguises the taste quite effectually, and for children is preferable, as a method of administration, to capsules or pills. In the case of adults the drug should be given in gelatin capsules or in the form of gelatin- or sugar-coated pills.

The tannate of quinine is comparatively tasteless, and may be incorporated with chocolate in the form of lozenges, thus being readily taken by children.

The drug may be also administered in a suppository by the rectum or incorporated in lard and rubbed into the skin, preferably in the axille and the inner side of the thighs or over the abdomen. It has been employed to some extent hypodermically, the quinine hydrobromate and bisulphate being the salts preferred for this purpose. Injections should be made in the buttocks, and very slowly administered, since this method of administration depresses the heart to a considerable degree.

Occasionally in the treatment of malaria Warburg's tincture, containing quinine and numerous aromatics, is efficient.

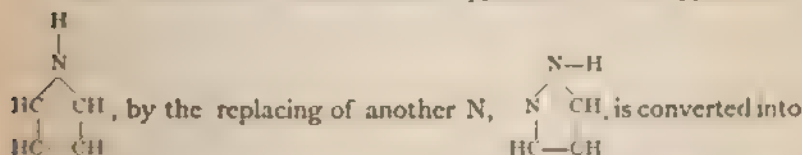
In obstinate malarial affections aromatics and spices greatly enhance the effect of quinine, capsicum making one of the best adjuvants. The portal circulation is stimulated, rendering the absorption of the drug more rapid and its effects more lasting.

The various tinctures and elixirs of cinchona are used extensively; when employed as stomachics they should be given before meals.

Quinine is best given on an empty stomach or after the active process of digestion is completed.

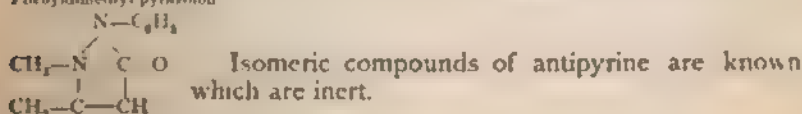
II. PYRRHOL GROUP.

These bodies are derivatives of pyrrazol. Thus pyrrhol,



pyrrazol. In antipyrine, a phenol radical is substituted for the NH of pyrrhol, and two methyl groups and oxygen introduced, thus—

Phenyldimethyl pyrrazolone



Antipyrina—Antipyrinæ—

Definition.—Phenylidimethylpyrazolin obtained by the condensation of phenylhydrazine with acetoacetic ether and methylhydrazine.

Description and Properties.—A white, slightly bitter taste, freely soluble in water, alcohol, and ether.

Dose.—3–20 grains (0.19–1.3 Gm.).

Antagonists and Incompatibles.—Antipyrine is incompatible with spirit of nitrous ether and nitrous oxide, and with solutions of mercuric iodine, the iodides of arsenic and antimony, solution of iodine, most of the tinctures, chloral, beta-naphthol, sodium bicarbonate, and the salts of quinine and caffeine.

Physiological Action.—On the stomach it irritates mucous membranes and causes flatulence. Hypodermically administered it often acts as a weak antiseptic.

Digestive System.—Antipyrine is absorbed rapidly. It is slightly irritant to the stomach, and by local contraction of the blood-vessels causes gastric stasis. It hinders the activity of ferments and may even cause nausea and vomiting on the intestines, because of its rapid action.

Circulation.—In small doses after administration the pressure the vessels dilate and the pulse is accelerated. The central pressure is not much affected. The peripheral pressure is accelerated, becomes slower. The circulation is diminished, and there is a distinct loss of blood and a weak, feeble pulse.

Antipyrine has no appreciable action on the heart. In this respect it varies greatly from the other antipyretics. From this point of view it is a much safer and more reliable drug.

Nervous System.—Antipyrine has a marked action on the nervous system. It causes irritability of the nervous system, bringing about convulsive movements, and about excitement and a peculiar type of delirium with marked general analgesia. It causes a diminution in its functions and in the intensity of its sensations. The cutaneous nerves of sensation are affected.

Temperature.—Antipyrine reduces fever. Its action in health is slight, due to increased surface evaporation and increase of perspiration. The exact mechanism is not understood. A certain proportion of the dose causes a retardation of metabolism. This is not the case with antipyrine as it is for the quinolines.

Antipyrine is very apt to cause eruptions. In these cases antipyrine should be withheld in these cases until the eruption is made.

Poisoning.—In large doses, 30 grains and over, in some individuals, even in smaller doses, it may bring about a marked feeling of chilliness, dyspnea vertigo with rapid and feeble heart action, unconsciousness, and collapse. Occasionally convulsive seizures are noted. Cyanosis is usually present irregular breathing, even Cheyne-Stokes rhythm, the pulse is small and death may result from cardiac collapse. The temperature usually falls, but often while the patient is in coma there may be a distinct rise in the temperature. 45 grains (3 Gm.) has caused death in a patient with a weak heart. 7½ grains (5 Gm.) has caused serious symptoms. The continuous use of small doses of antipyrine has been known to bring about a tendency to hemorrhages from the mucous membranes.

In large doses it causes slow and irregular breathing.

Absorption and Elimination—**Kidneys**—Antipyrine lessens the amount of urine, urea, and uric acid excreted, but increases the amount of sulphuric acid in the urine.

Therapeutics.—As an analgesic antipyrine probably ranks next to opium, and is useful in all conditions which call for the treatment of pain. The anesthesia produced by antipyrine often lasts for several hours or even days. In acute *coryza* and *inflammation of the pharynx* great relief is obtained by spraying the parts with a 2 or 4 per cent solution, after applying a solution of cocaine to prevent the primary smarting and irritation which the antipyrine produces.

A 20 per cent solution has been used in *vitro*, and a 4 per cent solution has been found very efficient in *vitro*.

Antipyrine has been used with some success in *diabetes mellitus* and *malarial diseases*, particularly in *intermittent fever*. It does not, however, possess the antiperiodic and specific action of quinine in malarial poisoning. It is an excellent antispasmodic in *conephegouch, hysteresis*, and *asthma*.

Administration—The drug is best given in water or some aromatic water or syrup. It should not be given hypodermically. In hemorrhage the powdered drug may be applied locally, or a 40 per cent solution, which causes less irritation. From $\frac{1}{2}$ –2 grains (0.03–0.12 Gm.), once or twice a day is sufficient for children. Ordinarily, a dose of 5 grains to 3 Gm. is sufficient for an adult.

Allied Compounds

Anything under with reason in form transpyn, with al'v' a. for form self-pyn, with al'v' a. for form hypoal'v' a. for form Pyan'v' a. for form Fennypyn is a form of the compound and a form of the compound are also. Anything is a compound end of a compound.

For a water drop 4 grains (0.350 gm = 350 milligrams), U = P

Caution—On account of the wide range of incompatibilities already indicated, the greatest caution should be observed in combining antipyrine with other substances.

III. HYDRAZINE DERIVATIVES

Practically none of the hydrazines, *hydrazine*, *pyrodine*, a related compound, *agathine*, a salicylic acid substitution product. They depress temperature very rapidly, temporary only, and as they cause severe shock, they are abandoned. The symptoms of poisoning have been: profuse sweating, with renosclerosis from the rapid formation of mucus, fluttering pulse with great depression, and respiratory failure.

IV. THE ANILINES

A large number of very valuable compounds have been found a definite place in practical medicine to increase very materially. In general, the action of all of the aniline derivatives is poisonous, but their toxic actions with proper dosage, on the nature of the substituted molecule of the substituted radical, the skin, the digestive tract, the nervous system are affected. Skin eruptions are various, pemphigus, ecthyma, or eczema may result.

The digestive symptoms are numerous, constipation is also characteristic, not infrequent.

The nervous system may present paralysis of the voluntary muscles particularly constant for all of the anilines.

The blood-changes induced by them are of importance. They may consist of oxidation of methemoglobin or even of hemoglobin production. These blood-changes are induced by para-amido-phenol, into which, or compounds, all of the derivatives of this series are included.

The number of these compounds is large, but that have been clinically valuable can be counted on the fingers of the hand. The earlier members of this group are

Acetanilidum¹—Acetanilide

Origin.—The monoacetyl derivation of aniline.

Description and Properties.—White, odorless, or a crystalline powder, odorless, faintly bluish, litmus paper. It is soluble, at 25° C. (77° F.), in 18 parts of boiling water, and in 0.4 part of boiling alcohol, and easily soluble in chloroform.

Dose.—2–10 grains (0.1–0.65 Gm.) [4 gr.]

¹ *Antifebrin* is a copyrighted name for acetanilide, sometimes called. Many proprietary remedies sold under the name of acetanilide and other compounds.

Official Preparation

Pulvis Acetanilidi Compositus—Pulvere Acetanilidi Compositi—Compound Acetanilid Powder (U. S. P.).—A mixture of acetanilid, caffeine and sodium bicarbonate; it is a modified version of the National Formulary article of the same name and has been known as acetanilid compound (Aulde). The sodium bicarbonate increases the solubility of the acetanilid.

Dose.—Average dose, 7½ grains (0.500 Gm. = 500 milligrammes), U. S. P.

Acetanilid is the cheapest of the common analgesics and it is extensively used in the "headache powders" sold under such a variety of names. These powders frequently contain also caffeine and an alkaline salt, usually sodium bicarbonate or sodium carbonate.

Physiological Action.—*Externally and Locally*.—Antiseptic, slightly sedative.

Internally—Digestive System.—Non-irritating, sedative, medicinal doses sometimes allay nausea.

Circulatory System.—In medicinal doses the arterial tension is slightly raised, while the heart is slowed. Toxic doses directly depress the heart and vasomotor mechanism, causing an immediate fall of arterial pressure and great cardiac depression.

In large doses or when taken for some time in comparatively small doses acetanilid develops the characteristic blood-changes spoken of. Methemoglobin is formed, and in very large doses hemolysis may occur.

Nervous System.—In medicinal doses acetanilid is a sedative to the sensory nerves and spinal cord. Small doses are mildly stimulant to the brain, and under certain conditions the drug is a hypnotic. Toxic doses result in general anesthesia and abolition of reflexes, with paralysis of motor and sensory nerves.

Respiratory System.—Medicinal doses produce no special effect. When toxic doses are given there is a rapid and labored respiration. Death is produced by respiratory failure due to direct action of the drug upon the respiratory center, and indirectly by greatly decreasing the oxygen-carrying power of the blood and by paralyzing the peripheral motor nerves.

Absorption and Elimination.—Acetanilid is an active diuretic, increasing the excretion of urea, and to some extent the excretion of uric acid. After toxic doses have been taken the urine becomes dark or brownish in color, from the presence of disorganized corpuscular elements of the blood. Acetanilid is chiefly eliminated by the kidneys as para-amido-phenol combined with acetic, sulphuric, or glucuronic acids.

Temperature.—Acetanilid has little or no effect on the normal body temperature, but if the latter is above normal, the drug has a marked antipyretic action, often reducing the temperature to below normal. This effect of acetanilid, and of the aniline group in general, is due largely to the action of the drug on the heat-governing mechanism. When the body is in a state of hyperpyrexia the heat-governing mechanism is in an irritable condition, owing

¹ For analysis of a number of these powders, see *Jour. Am. Med. Assoc.*, vol. xlv, p. 1791, 1905.

to certain poisons circulating in the blood. The normal limit (98.6° F.) of body temperature is maintained by this mechanism to respond to a low temperature by increasing its action on the vasomotor center, thereby augmenting the peripheral circulation and increasing the rate of heat-dissipation. The exact mechanism is not understood.

Dose.—Medicinal doses have no effect. Toxic doses have produced contracture.

Untoward Action.—Under prolonged use, enlargement of the liver, kidneys, and spleen, and jaundice have apparently been induced by the same, redness of the skin, chilliness, and sometimes chills ensued.

Poisoning.—The skin is cyanosed and the body is covered with cold sweat. The pulse is soft, slow, later rapid, and later weak. There is profound prostration. The respiration is shallow and later slow and very shallow, developing into respiratory paralysis. There may be convulsions, convulsions from asphyxiation. After death the heart, liver, and kidneys show acute fatty degeneration. $7\frac{1}{2}$ grains five days has caused death; 30 grains in 24 hours has also been fatal, and 1 grain caused death of a one-year-old child.

Treatment of Poisoning.—Diffuse cyanosis is relieved by small doses, ammonia, and sulphuric acid. Strychnine hypodermically as circulant. External heat and, if necessary, artificial respiration to overcome cyanosis. Artificial respiration.

Therapeutics.—*Externally* and locally applied for the treatment of ulcers and burns. It is also other antiseptics which are generally satisfactory. It is quite an active local anesthetic in *epistaxis* and *hemoptysis*.

Internally.—The use of acetanilide has been abandoned by the great majority of physicians. Its use is indicated at all, but it should be used only with great care, especially in cases of depression, profuse sweating, and coldness. It is not unsafe, in low conditions like *phthisis*. It may often be administered in the early stage of *pneumonia*. The headache and other symptoms in the *exanthemata* are relieved, although when this drug is given it should be carefully watched to avoid untoward effects.

In *acute tonsillitis*, in *influenza*, and in *fever*, it is very serviceable.

There is considerable difference of opinion in regard to the utility of acetanilid in *rheumatism*. Some authorities believe that it exercises a most favorable influence in the acute articular variety, being less apt to disturb the brain than salicylic acid or its salts. The drug certainly mitigates, and often entirely relieves, the pain and swelling, while it reduces the fever. Like salicylic acid, it has no power to prevent heart-complications, but, on the contrary, it should be used with great care, if at all, when such complications exist. It has no tendency to prevent relapses.

The dose of acetanilid in acute rheumatism should not exceed 6 grains (0.5 Gm.) three times a day.

Acetanilid is a very efficient analgesic, and the introduction of this drug, antipyrine, and other remedies of this character has enabled the physician to relieve the pains of certain *spinal diseases* more efficiently than was possible before.

The crises of *locomotor ataxia* are often promptly relieved by acetanilid. *Neuralgias* of every kind indicate its use. The pains of *neuritis*, *lumbago*, *gastrodynia*, *dysmenorrhea*, *sciatica*, *torticollis*, and nearly every kind of *headache* usually yield to its analgesic influence.

In many cases of *chorea* and *epilepsy* (especially the diurnal variety), and in those cases characterized by full habit and high arterial tension, the drug has often been employed to advantage.

Pains which are paroxysmal in character yield best to acetanilid. It quiets the excitement in *mania a potu*, and frequently lessens the paroxysms of *whooping-cough*.

In doses of 2 to 5 grains (0.2-0.32 Gm.) three daily, acetanilid has proved efficient as a relief for *tetanus*. It has also been found serviceable in traumatic *tetanus*, purely to quiet the nervous symptoms.

The author has found it to be of great value in *influenza*, or "La grippe," combined or given alternately with salol, aspirin, or sodium salicylate.

Contraindications.—In low fevers, at any rate, not in repeated doses, in fatty or dilated heart, blood disorders, advanced tubercular disease, and exhaustion from hemorrhages.

Administration.—It may be presented in powders, pills, compressed tablets, capsules or alcoholic solution. A quicker effect is produced if it is taken dissolved in a small quantity of alcohol or wine diluted with water.

The average dose as an antipyretic usually should not exceed 6 grains (0.5 Gm.) as an anodyne, 2 to 5 grains (0.1-0.3 Gm.). It may be repeated at intervals of about four hours or less, according to its effects.

Exsigine Methylacetanilide

Origin.—As the chemical name indicates, this substance is a derivative of acetanilid.

Description and Properties.—The pure compound is a white crystalline powder, with a faint tasteless. It is neutral to test paper, and is freely soluble in alcohol.

chloroform, carbon disulphide, and boiling water or 10 parts of ether for solution.

Dose. -2-4 grains (0.1-0.2 g.)

Antagonists and Incompatible with the iodides, salicylic acid, and so

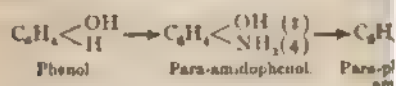
Synergists.—All members of the cocaine, belladonna, and hyoscyamine

Physiological Action.—Exalgine with acetanilid, with the exception of power. In medicinal doses the drug in full doses profoundly affects the circulation, uncertain and not as safe as acetanilid.

Acetphenetidinum—Acetphenetidinum. *U.*

(PHENACE)

Description.—The derivation of acetphenetidinum formulas:



It may be regarded as acetanilide, $\text{C}_6\text{H}_5\text{--}\begin{matrix} \text{O} \\ | \\ \text{NH}_2 \end{matrix}$ atom is replaced by the ethoxy group (OC_2H_5) in the form of fine crystalline powder, odorless in water (1:925), much more so in boiling water (1:12). It is frequently adulterated with acetophenone test.

Incompatibility.—Incompatible with acids, and oxidizing agents.

Dose.—Average dose, $7\frac{1}{2}$ grains (0.500 g.)

Physiological Action.—Phenacetin in the greater slowness of its action

It is a distinct diuretic, but not in large doses have been taken the urine gives the reaction for sugar.

As an antipyretic phenacetin is not so powerful as an analgesic and is it so powerful as an analgesic and

Therapeutics.—Phenacetin is given as acetanilid.

Contraindications.—The same

Administration.—The drug may be given in capsules, tablets, or suspended in water

Phenol

Origin.—Amido-acetparaphenetidin, a phenol hydrochloride is the salt used in medicine

Description and Properties.—A white, crystalline powder, soluble in 16 parts of water and freely soluble in hot alcohol, forming a neutral solution.

Dose.—3-15 grains (0.2-1.0 Gm.).

Incompatibles.—All the alkalies.

Physiological Action.—Phenocoll differs from phenacetine in no essential particulars.

Other phenetidine bodies are:

Lactophenin, in which a lactyl derivative is added to phenetidine. It is more soluble than phenacetine, and the lactyl group is supposed to add some hypnotic action.

Saliphenin is too weak to be of any service.

Citrophen and *Apolysin* are combinations of citric acid and phenetidin. The citric acid radical was added for its stimulating effect on the heart, and hence these two are reputed to overcome the phenetidin-depressing effect on this viscus. The action, however, clinically, cannot be detected from that of phenacetin, and, moreover, there are certain objections, in the way of the splitting of these compounds in the stomach, which render them less suitable than phenacetine.

Salicylphenetidin was devised to combine the antirheumatic and antipyretic factors, but it appears that this compound is too stable and does not break up into its constituents, and is found in the urine in its original form.

Milakin is somewhat similar to the former drug. It breaks off a phenetidin, however, but is very slow of action and requires large doses to reduce the temperature.

Salicoll is similar to phenocoll plus salicylic acid.

Phenin and *Cosaprin* are new sulphur compounds of phenacetin and acetanilid, respectively, in which the sulphur radical is introduced to reduce the blood-toxic action. They offer no particular advantages.

RESTORATIVES AND

THESE old terms of the *Materia Medica* are used for purposes of convenience. By them is meant that they exert a distinct influence on the metal organs, and that they thus alter the action of the organs in part or as a whole, and that they have therapeutic effects to so influence certain metabolic processes that arsenic affects the nutrition of the blood, amounts characteristic nutritional disturbance to play in the blood-composition of the body. Mercury has a peculiar action on the states, and exerts a specific activity in syphilitic infection—how, it is as yet unknown. Other illustrate show similar properties. Other illustrate

It is obvious to every reflecting physician that they act as such by supplying some deficiency, the agent in such cases being either iron or its analogue, or by its presence restoring normal secretion. Iron acts in certain forms of anemia when iron is wanting in the red blood-cells. Earthy salts behave similarly in certain cases. Iron is deficient in these necessary constituents. The logical action of remedies belonging to this group so aptly expresses their general character that they are needed for its adoption.

Alteratives, on the other hand, are remedies which can be administered without injurious effects in diseased conditions, in which the particular cause or unknown way the prime etiologic factor is the medicines when given as *alteratives* in the patient being unaware of their action, and the condition gradually improved condition. Should they should serve as a warning that the dose is unsuitable.

Restoratives and alteratives belong to a general group of the metals and metalloids, and have similarities of action.

RESTORATIVES

Ferrum—Fërri -Iron

Definition.—Metallic iron, in the form of

Preparations

Ferrum Reductum Fërri Reducti-
HYDROGEN (QUEVENNE'S IRON) - Origin.—A hot, closed tube containing freshly prepared iron should contain not less than 90 per cent. of pure

Description and Properties.—A very fine, grayish-black, lustrous powder, odorless and tasteless, permanent in dry air, insoluble in water or acids.

Dose.—1-5 grains (0.05-0.3 gm.) [1 grain (0.05 gm.), U. S. P.]

Ferri Carbonas Saccharatus—**Ferri Carbonatis Saccharati**—**Saccharated Ferrous Carbonate** (U. S. P.).—*Origin.*—Prepared from ferrous sulfate, sodium bicarbonate, sugar, and distilled water by solution and filtration. It should contain not less than 15 per cent. of ferrous carbonate.

Description and Properties.—A greenish-brown powder gradually becoming oxidized by contact with air, without odor, and having at first a sweetish-almond and a slightly ferruginous taste. Only partly soluble in water, but completely soluble in hydrochloric acid, with copious evolution of carbonic acid gas, forming a clear, greenish-yellow liquid. The product should be kept in small, well-stoppered bottles.

Dose.—2-10 grains (0.12-0.6 gm.) [4 grains (0.25 gm.), U. S. P.]

Massa Ferri Carbonatis—**Massa Ferri Carbonatis**—**Mass of Ferrous Carbonate** (U. S. P.).—*VALLET'S MASSA.*—*Origin.*—Prepared by solution, filtration, and evaporation from ferrous sulfate, sodium carbonate, clarified honey, sugar, syrup, and distilled water.

Description and Properties.—When recently prepared, the mass is of a greenish-gray color, but on exposure it becomes greenish-black.

Dose.—3 grains (0.15-0.3 gm.) [4 grains (0.25 gm.), U. S. P.]

Mistura Ferri Composita—**Mistura Ferri Composita**—**Compound Iron Mixture** (U. S. P.).—*CHATELAIN'S MIXTURE.*—*Origin.*—Prepared by mixing ferrous sulfate, myrrh, sugar, potassium carbonate, spirit of anise, and rose water.

Description and Properties.—When newly prepared it is of a dirty greenish color, but slowly oxidizes on exposure to the air, and should therefore be freshly prepared when needed.

Dose.—1-1½ ounces (15-45.0 Cc.) [4 drams (16 Cc.), U. S. P.]

Pilule Ferri Iodidi—**Pilule Ferri Iodidi**—**Pills of Ferrous Iodide** (U. S. P.).—*CHATELAIN'S PILLS.*—*Origin.*—Prepared by mixing a sugar extract of glycyrrhiza, cream, balsam of tolu, water, and ether, evaporated to a dry consistency.

Description and Properties.—These preparations are very unstable, and should be kept from the light as far as possible.

Dose.—Three or four pills, each pill containing nearly 1 grain (0.05 gm.) of ferrous iodide.

Syrupus Ferri Iodidi—**Syrupi Ferri Iodidi**—**Syrup of Ferrous Iodide** (U. S. P.).—*Origin.*—A simple syrup containing 5 per cent. by weight of ferrous iodide.

Description and Properties.—A thin, clear, pale green liquid, having a sweet, strong ferruginous taste and a neutral reaction.

Dose.—5-10 minims (0.25-0.5 Cc.) [15 minims (0.75 Cc.), U. S. P.]

Ferri Chloridum—**Ferri Chloridi**—**Ferric Chloride**—*Origin.*—Prepared by the action of hydrochloric acid on iron filings in distilled water upon a wire gauze with stirring, and evaporation. It should contain not less than 20 per cent. of iron in the form of chloride.

Description and Properties.—Orange-red or brown, crystalline pieces, rhombohedral, or having a flat rhomb of habit, white and lustrous at the angles, taste very disagreeable, soluble at first and completely soluble on warming in water, and in alcohol 1 part of ether and 1 part of alcohol. Ferric chloride should be kept in glass-stoppered bottles, protected from light.

Dose.—It is chiefly used topically, as an astringent and hemostatic [1 grain (0.05 gm.), U. S. P.]

Liquor Ferri Chloridi—**Liquoris Ferri Chloridi**—**Solution of Ferric Chloride** (U. S. P.).—*Origin.*—An aqueous solution of ferric chloride, containing not less than 20 per cent. of the anhydrous salt, corresponding to 10 per cent. of metallic iron.

Description and Properties.—A reddish-brown liquid, having a faint odor of hydrochloric acid, strong astringent and hemostatic.

Dose.—2-10 minims (0.1-0.5 Cc.), largely diluted [2 minims (0.1 Cc.), U. S. P.]

Tinctura Ferri Chloridi—**Tinctura Ferri Chloridi**—**Tincture of Ferric Chloride** (U. S. P.).—*Origin.*—A liquid containing 10 per cent. of the anhydrous salt, corresponding to 5 per cent. of metallic iron.

Description and Properties.—A bright brownish liquid, having a slightly ethereal odor, a very astringent, agreeable taste, and an oxidizing reaction.

Dose.—5-30 minims (0.3-2.0 Cc.) [8 minims]

Liquor Ferrī et Ammonii Acetatis—Liquor

Solution of Iron and Ammonium Acetate (U. S. P.)

Formula.—Prepared with tincture of ferric chloride, 60; solution of ammonium acetate, 500; aroids to 1000.

Dose.—4-4 fluidrams (4.0-15.0 Cc.) [4 fluidrams]

Ferrī Citras—**Ferrī Citratus**—**Ferric Citrate**

by evaporating solution of ferric citrate on a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron.

Description and Properties.—Thin, transparent, and having a slightly ferruginous taste. Slowly and readily soluble in hot water, but diminishing solubility in alcohol. Ferric citrate should be kept in well-stoppered bottles.

Dose.—5-20 grains (0.3-1.2 Gm.) [0.1-0.4 gram]

Vinum Ferrī—**Vini Ferrī**—**Wine of Iron**

ammonium citrate, tincture of sweet-orange peel

Dose.—4-1 fluidram (2.0-4.0 Cc.) [2 fluidrams]

Ferrī et Ammonii Citras—**Ferrī et Ammonii Citratus**—**Ferric and Ammonium Citrate** (U. S. P.).—*Origin*.—Prepared by

and ammonia water.

Description and Properties.—Thin, transparent, having a saline, insidiously ferruginous taste; deliquescent in water, but insoluble in alcohol.

Dose.—5-10 grains (0.3-0.6 Gm.) [4 grains]

Ferrī et Quininae Citras—**Ferrī et Quininae Citratus**—**Ferric and Quinine Citrate** (U. S. P.).—*Origin*.—Solution of ferric

of quinine and citric acid in distilled water at the consistence of syrup, and dried on plates of glass.

Description and Properties.—Thin, transparent, without odor, and having a bitter, mildly ferruginous taste. Gradually but completely soluble in hot water, and but partially soluble in alcohol. Should be kept in well-stoppered bottles, protected from light.

Dose.—2-10 grains (0.12-0.6 Gm.) [4 grains]

Elixir Ferrī, Quininae et Strychninae Phosphati—**Elixir of Iron, Quinine, and Strychnine Phosphate** (U. S. P.).—Each fluidram contains 1 grain (0.0648 Gm.) of quinine, and $\frac{1}{4}$ grain (0.00635 Gm.) of strychnine, and a large excess of sugar.

Ferrī et Quininae Citras Solubilis—**Ferric and Quinine Citrate Soluble** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—2-10 grains (0.12-0.6 Gm.) [4 grains]

Ferrī et Strychninae Citras—**Ferrī et Strychninae Citratus**—**Ferric and Strychnine Citrate** (U. S. P.).—*Origin*.—Solution of ferric citrate and strychnine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and strychnine citrate not less than 16 per cent. of strychnine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—2-10 grains (0.12-0.6 Gm.) [4 grains]

Vinum Ferrī Amārum—**Vini Ferrī Amari**—**Wine of Iron and Quinine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-3 grains (0.06-0.18 Gm.) [2 grains]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-2 fluidrams (4.0-8.0 Cc.) [2 fluidrams]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-3 grains (0.06-0.18 Gm.) [2 grains]

Vinum Ferrī Amārum—**Vini Ferrī Amari**—**Wine of Iron and Quinine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-2 fluidrams (4.0-8.0 Cc.) [2 fluidrams]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-2 fluidrams (4.0-8.0 Cc.) [2 fluidrams]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-2 fluidrams (4.0-8.0 Cc.) [2 fluidrams]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

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Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

Dose.—1-2 fluidrams (4.0-8.0 Cc.) [2 fluidrams]

Syrupus Ferrī, Quininae et Strychninae—**Syrup of Iron, Quinine, and Strychnine** (U. S. P.).—*Origin*.—Solution of ferric citrate and quinine citrate in distilled water at the consistence of syrup by means of a water bath at 60° C. (140° F.). It should contain ferric citrate not less than 16 per cent. of metallic iron, and quinine citrate not less than 16 per cent. of quinine.

Description and Properties.—Thin, transparent, colorless, and having a bitter, mildly ferruginous taste. Rapidly and completely soluble in cold water, and should be kept in well-stoppered bottles, protected from light.

et Strychnina Phosphatum—Syrup of the Phosphates of Iron, Quinine, and Strychnine (U. S. P.)—Dose—1-2 dramms (4-8.0 cc.) (1 dram = 4 cc.), (U. S. P.)

Ferri Hydroxidum—Ferri Hydroxide—Ferric Hydroxide (U. S. P.) (Hydrated Oxide of Iron, Ferri Oxidum Hydratum, U. S. P. (1897).—Obtained by adding a solution of ammonia water in water to a 100 cc. solution of ferric sulphate in water, and the precipitate collected.

Description and Properties.—A brownish-red mass, wholly soluble in hydrochloric acid, without effervescence.

Dose—4 drams (16 gm.) or ad libitum in case of arsenical poisoning.

Ferri Hydroxidum cum Magnesia—Ferri Hydroxidum cum Magnesia—Ferric Hydroxide with Magnesia (U. S. P.)—Solution of ferric sulphate, magnesia, and water.

Dose—Amounts as necessary ad libitum.

Ferri et Ammonii Sulphas—Ferri et Ammonii Sulphatis—Ferric Ammonium Sulphate (U. S. P.)—Ammonioferri Sulphas—Ammonioferri Sulphas—The crystals formed by adding ammonium sulphate to a boiling hot solution of ferric sulphate.

Description and Properties.—Pale violet, octahedral crystals, odorless, and having an acid, styptic taste; eff. solvent on exposure to the air. Soluble in 1 part of water and in 0.8 part of boiling water; insoluble in alcohol. The product should be kept in well-stoppered bottles.

Dose—5-15 grains (0.3-1.0 gm.) (7½ grains (0.5 gm.), U. S. P.)

Ferri et Ammonii Tartras—Ferri et Ammonii Tartratis—Iron and Ammonium Tartrate (U. S. P.)—Ammonioferri Tartratis—Ammonioferri Tartratis—Thin, transparent scales, varying in color from garnet red to reddish brown, without color, and having a sweetish slightly ferruginous taste; slightly effervescent in the air. Very soluble in water; insoluble in alcohol. Iron and ammonium tartrate should be kept in well-stoppered bottles, protected from light.

Dose—10-30 grains (0.6-2.0 gm.) (4 grains (0.25 gm.), U. S. P.)

Ferri et Potassii Tartras—Ferri et Potassii Tartratis—Iron and Potassium Tartrate (U. S. P.)—Potassioferri Tartratis—Potassioferri Tartratis—Thin, transparent scales, varying in color from garnet red to reddish brown, without color, and having a sweetish slightly ferruginous taste; slightly effervescent in the air. Very soluble in water; insoluble in alcohol. It should be kept in well-stoppered bottles, protected from light.

Dose—5-20 grains (0.3-1.2 gm.) (4 grains (0.25 gm.), U. S. P.)

Ferri Phosphas Solubilis—Ferri Phosphatis Solubilis—Soluble Ferric Phosphate (U. S. P.)—*Description and Properties*.—Thin, bright green transparent scales, odorless, and having an astringent, slightly saline taste. The salt is permanent in dry air when excluded from light, becoming dark and discolored when exposed to it. Freely and completely soluble in water, but insoluble in alcohol. It should be kept in dark amber-colored, well-stoppered bottles. 10 per cent. mass for mass.

Dose—5-10 grains (0.3-0.6 gm.) (4 grains (0.25 gm.), U. S. P.)

Ferri Pyrophosphas Solubilis—Ferri Pyrophosphatis Solubilis—Soluble Ferric Pyrophosphate (U. S. P.)—*Description and Properties*.—Thin, apple green, transparent scales, without color, and having an astringent, slightly saline taste; permanent in dry air if protected from light, and if exposed to it becoming dark and discolored. Freely and completely soluble in water, but insoluble in alcohol. It should be kept in dark amber-colored, well-stoppered bottles. 10 per cent. mass for mass.

Dose—2-4 grains (0.1-0.3 gm.) (4 grains (0.25 gm.), U. S. P.)

Ferri Hypophosphas—Ferri Hypophosphitis—Ferric Hypophosphate (U. S. P.)—*Description*.—The precipitate formed by mixing solutions of sodium hypophosphite and ferric chloride or ferric sulphate.

Description and Properties.—A white or grayish white powder, colorless and nearly tasteless when dry in the air. Slightly soluble in water. It should be kept in well-stoppered bottles.

Dose—6-10 grains (0.4-0.6 gm.) (3 grains (0.2 gm.), U. S. P.)

Ferri Sulphas—Ferri Sulphatis—Ferrous Sulphate (U. S. P.)—*Description*.—Crystals of the green sulphate and acid green sulphate.

Description and Properties.—Large prismatic green crystals, without color, and having a saline, styptic taste. Effervescent in dry air on exposure to moist

air the crystals rapidly absorb oxygen, becoming ferric sulphate. Soluble in 1.8 parts of water; soluble in alcohol.

Dose.—1-3 grains (0.06-0.18 Gm.) [3 grains]
Ferri Sulphas Exsiccatus—**Ferri Sulphate** (U. S. P.).—*Description and Properties*—completely soluble in water.

Dose.—½-2 grains (0.03-0.12 Gm.) [2 grains]
Ferri Sulphas Granulatus—**Ferri Sulphate** (U. S. P.).—*Description and Properties*—powder, which should conform in every respect to **Ferri Sulphas** in the U. S. P.

Dose.—½-3 grains (0.03-0.18 Gm.) [3 grains]
Liquor Ferri Subsulphatus—**Liquoris Ferri Subsulphate** (U. S. P.).—*SECTION OF BASIC IRON*.—*Origin*.—An aqueous solution of basic composition—corresponding to about 13.6 per cent.

Description and Properties.—A dark, reddish acid, strongly styptic taste, and an acid reaction in all proportions, without decomposition.

Dose.—1-10 minims (0.06-0.6 Cc.) [3 minims]—chiefly used, however, as a local styptic.

Liquor Ferri Tersulphatus—**Liquoris Ferri Sulphate** (U. S. P.).—*Origin*.—An aqueous solution about 30 per cent. of normal ferric sulphate to per cent. of metallic iron.

Description and Properties.—A dark, reddish acid, strongly styptic taste, and an acid reaction in all proportions, without decomposition.

Dose.—1-10 minims (0.06-0.6 Cc.), gives purposes as the preceding preparation.

Pilule Aloes et Ferri—**Pilulas** (acc.)
Iron (U. S. P.).—Described under *Aloes*.

Dose.—5-10 grains (0.3-0.6 Gr.) [1 or two grains]
Pilule Ferri Carbonatis—**Pilulas** (acc.)

Carbonate (U. S. P.).—**FERRUGINOUS PILLS**.—*Dose*.—2-5 pills, each pill containing 1 grain.

Allied Comp

Hæmogallol.—*Origin*.—Prepared by the matter of the blood.

Description and Properties.—A reddish br

Dose.—1-8 grains (0.06-0.5 Gm.)

Hæmol.—*Origin*.—Prepared by the action the blood.

Description and Properties.—A blackish-br

Dose.—1-8 grains (0.06-0.5 Gm.)

Ferratin.—*Origin*.—A compound of iron from hog's liver.

Description and Properties.—A fine, reddish cent. of iron. One variety is insoluble, though water.

Dose.—10-20 grains (0.16-1.2 Gm.).

Hæmalbumin.—A preparation said to co blood.

Description and Properties.—A permanent

Dose.—5-15 grains (0.3-1.0 Gm.)

Hæmoglobin.—Said to be the coloring-pr

Dose.—1-5 grains (0.06-0.18 Gm.)

Hæmoferrum.—Claimed to be a natural bullock's blood.

Dose.—1-3 grains (0.06-0.18 Gm.)

Iron Quinine Chloride.—A yellowish-red powder, soluble in water, alcohol, and glycerin.

Dose.—1-3 grains (0.06-0.18 Gm.). Used externally as a hemostatic.

Other newer preparations of iron are **Petalboid**, a potassium albuminate of iron, **Ferremol**, a compound of ferric and iron, containing 1 per cent of iron. *Dose*, 3-8 grains (0.2-0.5 Gm.). **Ferralbumose**, prepared from lactose meat and treated with artificial gastric juice, the ferred substance is freed from albumin, filtered, concentrated, and dried in vacuo. A 10 per cent solution of this albumose is precipitated by 10 per cent ferric chloride and the precipitate is then dried and powdered. **Ferripyrene**, a combination with three molecules of antipyrine and one of ferric chloride, and said to possess the properties of both constituents. *Dose*, 5 grains to 5 Gm. in an anæmic condition associated with headaches and nervousgia.

Ferrosol is a double succinate of ferrous oxide and sodium chloride. It is not precipitated by the addition of acids, alkalis, or by changes in temperature. It contains 0.7 per cent of iron. **Ferrostypin**, an iron preparation containing ferrous chloride and readily soluble in water, is used as a hemostatic, astringent. It does not cause constipation in the mouth and nose. *Dose*, 5-8 grains (0.3-0.5 Gm.). **Ferrum caseinatum**, a preparation containing 5.2 per cent ferric oxide, and prepared by precipitating a solution of ferric chloride with a solution of calcium caseinate. It is tasteless and odorless, and swells in water made alkaline by sodium carbonate. *Dose*, 5-15 grains (0.3-1.0 Gm.). **Ferran** is one of the many new preparations of blood. It is said to be the plasma and containing albumin of the blood. **Sanguinal**, **Sanguiniform**, and **Carminferin** are other blood preparations. Many other preparations of iron are daily being added to the already abundant list.

Antagonists and Incompatibles.—The ferric salts are incompatible with tannic and gallic acids and vegetable astringents, and gelatinize mucilage of acacia. The carbonates are also incompatible with tannic and mineral acids and acidulous salts.

The salts of the vegetable acids and the iodides are incompatible with mineral acids, tannic acid, and with alkalis and their carbonates.

Synergists.—All the restorative medicines are synergistic.

Physiological Action.—Iron is an essential element of the body, there being 1 part of iron to 230 of red globules. In many lower animals iron is diffused throughout the bodily protoplasm, in man it is mostly confined to one tissue, the blood. Through the iron compounds of the body much of the oxidizing functions of the various cells are carried on.

When the body is in a normal healthy condition, sufficient iron is furnished by the mixed diet to answer all physiological requirements. In many diseased conditions, however, there is a deficiency of iron, and it is necessary to restore this element in one way or another.

Externally and Locally.—Neither the soluble ferric nor ferrous salts exert any action upon the unbroken skin. When applied, however, to mucous membranes or denuded surfaces, they are astringent and hemostatic, the ferric salts being the more powerful, coagulating albuminous fluids. The coagulatum of albuminate of iron is usually insoluble, hence acts as a protectant and limits penetration or corrosion. The organic salts possess feeble astringent properties. In the iron salts the acid iron plays the more important role in its action on protoplasm.

The acid and astringent preparations of iron act upon the teeth.

The ferric oxides are disinfectant, oxidizing oxygen into ozone.

Internally.—Digestive System.—Tolerated by the preparations of iron. In overdoses and in small doses, its properties render iron quite a valuable agent. Excessive doses or prolonged administration especially are apt to cause gastric distress and serious indigestion. The ferric chloride is tolerable in that its ingestion does not, like iron, diminish the supply of hydrochloric acid.

All the preparations of iron are absorbed in the stomach. When ferric chloride is converted into the ferric oxide, ferrous sulphate, and the insoluble sulphide preparations are constipating, the former being exceptions. They tend to discontinue the secretions from the gastro-intestinal tract. Constipation is a frequent result of iron medication.

Circulatory System.—The action of iron is of great importance, since the metal enters the blood fluid, its administration has a powerful influence. A primary effect is to stimulate the capillaries and bring the hemoglobin into the blood corpuscles and also increases the number of leucocytes. It also increases the number of leucocytes to convey more oxygen to the tissues, and metabolic activity in general. Long continued use is thought to develop a sense of fulness of the chest, and a tendency to hemorrhage from the mucous membranes.

Nervous System.—The general effect is to incline to plethora, however, certain undue effects result from prolonged administration, including headache in the cerebrum.

Respiratory System.—No immediate effect in normal conditions, but in anemic states it stimulates the centers, muscles, and lungs with better results. The action is increased.

Absorption and Elimination.—Opinion differs as to in which iron is absorbed. Probably the soluble chloride is absorbed and a portion, passing into the intestines, is converted into the soluble alkaline albuminate capal. A portion of iron taken into the system is excreted as insoluble sulphide and tannate, and causes feces a black color. Such part of the iron as combines with the red corpuscles, is absorbed directly into the blood.

Such careful pharmacologists as Hamburger claimed that inorganic p

absorbed nor assimilated, maintaining that the blood and hemoglobin are influenced only by the organic compounds. Yet, notwithstanding these statements, clinical experience has fully demonstrated the value of such preparations as reduced iron, tincture of the chloride, carbonate, etc., and it is still perhaps a mooted question whether appreciable amounts of them are actually absorbed, or whether, according to Bunge, the inorganic prevent the decomposition of the organic salts of iron in the food by fixing the decomposing agents in the intestines. At all events, the beneficial results in anemia and chlorosis of large doses of the inorganic preparations are too manifest to justify abandonment of these agents because of our ignorance touching their *modus operandi*.

At the present time it is fairly well conceded that Bunge was wrong in his general hypothesis, and the recent work of many pharmacologists has shown that most of the ordinary preparations are capable of absorption in the intestine, and it is also probable that iron takes part in a number of synthetic combinations in the liver, some of which may be utilized in normal metabolism, while others are cast off in the bile and thus re-enter the intestinal canal.

The amount of urea is increased and micturition rendered more frequent by preparations of this metal.

Elimination takes place chiefly by the feces, to which a blackish color is imparted by the formation of ferrous sulphide. The bile, urine, and even the skin, as well as the mucous and serous membranes, share in the excretory process.

Unfavorable Action.—The continued use of ferruginous preparations has a tendency to impair the normal digestive powers, occasioning even gastric oppression, nausea, and vomiting. Reduced iron, the phosphate, and the pyrophosphate produce less untoward action than other preparations, and the ferrous are better tolerated than the ferric salts. Not infrequently acne of the face, breast, and back is occasioned, while the prolonged administration of the drug may in rare cases be accompanied by hemorrhages from the mucous membranes and symptoms of plethora and vascular excitement. Large doses of the ferrous sulphate may occasion obstruction of the bowels. In some rare instances irritation of the kidneys may be induced, and again iron is often badly tolerated in gouty conditions.

Poisoning.—The ferric preparations in a concentrated form produce all the symptoms of an irritant poison—gastric pain, vomiting, etc.

Treatment of Poisoning.—The stomach should be emptied by an emetic or carefully cleansed the treatment being followed by the administration of alkali solutions, tannic acid, and demulcent drinks, the procedure being similar to that employed in poisoning from mineral acids.

Therapeutics.—*Externally and Locally*.—The astringent and styptic properties of chlorides and sulphates of iron have rendered

them serviceable in controlling hemo in relaxed conditions of the *pharynx* branes generally. The tincture of recommended as a local application *chronic* and *indolent ulcers* may oftaining from 2 to 5 grains (0.12-0 ounce (30.0 Cc.) of water. In subactincture of the chloride with glyceri of potash makes an effective mixture.

It is important to remember t the astringent salts of iron in deep ones. Pressure will usually fulfil a gent.

Iron baths are probably of little

Internally.—The most important number of red corpuscles and the an the primary and secondary anemia, especially, it is of great value; but i most beneficial, cathartics, such as r irritate the intestines, should acco types of secondary anemia iron is o therefore following *hemorrhage*, *acute fever*, *puerperal fever*, *diphtheria*, *mucositis*, *syphilis*, etc.

In many constitutional disturbanc iron is of service. Thus in the *neur* anemia is a concomitant cause, in *themia*, in the anemia of the *optum* c mias due to chronic toxemia of *B* particularly as Basham's mixture.

Contraindications.—Iron is co stomach irritability, as is seen in febr disorders of that viscus. As a rule, in acute inflammatory conditions, i hemorrhagic diathesis.

Administration.—If the appetite l tered in small doses (invariably after bitters. The tincture of the chloride should be freely diluted with water. T ration well adapted for children and

Probably the salt richest in iron preparations the most agreeable and potassium tartrate. The soluble f mild and pleasant preparation. The sesses special advantages in the treat diseases of the skin, while the sol acetate (Basham's mixture) is the bes particularly that accompanying tub able and well tolerated.

The best styptic is the ferric subsulphate or its solution.

Dialyzed iron, being agreeable to the taste, was formerly a popular remedy.

Although it has been shown that Bunge's theory of the inability of the body to utilize inorganic salts of iron is untrue, yet many of the newer proteid combinations serve very acceptably in modern therapeutics, especially in those rare cases in which marked idiosyncrasies to the effects of iron exist. Apart from such, however, there is, we believe, little justification, from an economic point at least, in the use of the numerous patented alcoholic combinations of iron salts.

MANGANESE.

This metal is a normal constituent of the body, existing in appreciable, though minute, quantities in the blood bile, etc. From the fact of its presence in the blood, and because of the similarity of its chemical affinities to those of iron, many observers have advocated its use as a worthy and efficient substitute for the latter agent.

Its therapeutic uses as a restorative, or as an alternative or synergist to iron, are based more upon abstract deductions than upon clinical observation. Still, as its chemical character resembles that of iron—though the metal in its operation is often antagonistic to the latter—its salts are of sufficient therapeutic importance to merit brief mention here.

Mangani Dióxidum Precipitátum—Mangani Dióxidi Precipitatæ—Precipitated Manganese Dioxide. U. S. P.

Definition. Chiefly manganese dioxide with small amounts of other oxides of manganese, containing not less than 80 per cent. of manganese dioxide.

Origin. Manganese sulphate 40, ammonia water, 240, solution of hydrogen dioxide, 200, water, q. s.

Description and Properties. A heavy, very fine black powder, without odour or taste, permanent in the air, insoluble in water.

Dose.—5 grains (0.3264 gm.), 4 grains (0.25 gm.). [U. S. P.]

Mangani Hypophosphis—Mangani Hypophosphis - Manganese Hypophosphites. U. S. P.

Definition. It shall contain not less than 97 per cent. of pure manganese hypophosphite, $Mn(H_2PO_2)_2 \cdot H_2O$.

Dose. Average dose, 1 grain (0.065 gm.) to 20, or 30, grains (1.3 to 2 gm.). [U. S. P.] It is contained in various hypophosphites sold abroad.

Mangani Sulphas—Mangani Sulphatis—Manganese Sulphate. U. S. P.

Origin. Prepared by heating manganese ore with sulphuric acid, and purifying the product by solution and crystallization.

Description and Properties. A white or pale rose-colored granular,

tetragonal prisms, odorless, and having a slight efflorescent in dry air. Soluble in 0.7 part of water; insoluble in alcohol. Manganese sulphate shows

Dose.—2-5 grains (0.1-0.3 Gm.) [4 gral

(For *Potassium Permanganate* see

Antagonists and Incompatibles

mercury are incompatible with many

Synergists.—Iron is theoretically zinc, copper, and silver are similar in system.

Physiological Action.—*Externally* above mentioned have no important

Internally.—In large doses these irritate the gastro-intestinal tract, with occasional gastro-enteritis. The sulphate and possesses cholagogue properties.

As is the case with many other doses may even promote the appetite function. Manganese dioxide is held to have some rôle as a tissue oxidizer; very similar to that of iron. It has been shown to have a certain catalytic power in the blood. Continued administration of these salts is more like zinc than iron, producing weakness and waste, diminishing heart, and lowering arterial tension, leading to fatty degeneration of the myocardium.

Therapeutics.—The manganese salts are used in amenorrhea and dysmenorrhea, and in *gastralgia*, *pyrosis*, and *simple uterine* probably resembles that of bismuth. It is an efficient remedy than the latter drug.

It is of interest to note that menorrhagia does not derive no benefit from the use of manganese in treatment of amenorrhea.

The sulphate is used occasionally in *malarial jaundice*, although why it is other and superior cholagogues it is not clear. *Dyspepsia* appears to have been more benefited by manganese. The association of iron and manganese is a valuable combination in the treatment of variations of secondary anemia.

Phosphorus—Phosphori—

Definition.—It should contain not less than 95 per cent.

Origin.—It exists, chiefly as phosphates, in many animals. It is prepared by treating calcined bones with sulphuric acid and distillation.

Description and Properties.—A white, waxy luster, having at ordinary temperatures a

kept for some time the surface becomes red and occasionally black. Phosphorus has a distinctive and disagreeable odor and taste. *Testing*: being a *volatile solid*, in the form of *extreme density*. When exposed to the air it emits white fumes, visible in the dark, which have an odor somewhat resembling that of garlic. Upon prolonged exposure to air it takes fire spontaneously.

Phosphorus is insoluble, or nearly so, in water to which, however, it imparts its characteristic disagreeable odor and taste. It is soluble in 250 parts of alcohol or alcohol, in 100 parts of absolute ether, and in about 50 parts of any fatty oil. It is very soluble in bisulphide of carbon or in carbon disulphide, the latter yielding a solution to be handled with the greatest care to prevent accident from combustion. The drug should be carefully kept under water in strong, well-closed vessels, in a secure and moderately cool place, protected from light.

Dose.— $\frac{1}{12}$ – $\frac{1}{4}$ grain (0.0006–0.002 Gm.) ($\frac{1}{12}$ grain (0.0005 Gm.), U. S. P.).

Official Preparation.

Pilule Phosphori—**Pilulas** (acc.) **Phosphori**—**Pills of Phosphorus**.—*Four*, one or two pills. Each pill contains $\frac{1}{12}$ grain (0.0006 Gm.) of phosphorus.

Antagonists and Incompatibles.—The principal chemical antidotes are hydrated magnesia, lime water, powdered charcoal, copper sulphate, and old acid turpentine.

Synergists.—Only oily or fatty substances generally aid the action of phosphorus by increasing its absorbability. Cod-liver oil and the restoratives generally aid the action of phosphorus.

Physiological Action.—*Externally and Locally.*—Applied to the skin, phosphorus causes local inflammation, ulceration, and possibly gangrene. The fumes, so common in factories in which phosphorus is used—*i. e.*, in making matches—may produce the most serious results—even maxillary necrosis where dental caries is present, as well as great irritation of the conjunctiva and the respiratory mucous membrane. The graver systemic symptoms are confined to the conditions induced by toxic doses of the drug.

Internally—Digestive System.—Taken into the stomach, no special effect is apparent as a result of small doses, save that the drug acts as a functional stimulant. Ferment action is not impaired by non-poisonous doses. Large non-toxic doses cause irritation, with anorexia, increased peristalsis, diarrhea. Fatty degeneration of the cells of the mucosa is readily induced.

Circulatory System.—The primary action is stimulating, the pulse-rate rising and acquiring more force, though not firmness. The facial capillaries are dilated, often congested, the cutaneous circulation becomes more rapid, and diaphoresis is produced. Under toxic doses the action of the heart is strongly depressed.

Nervous System.—Small or moderate doses act as general stimulants to the entire nervous system. Toxic effects include coma, and occasionally vertigo, with delirium, convulsions, insensibility, and collapse.

Respiratory System.—The deleterious action of the fumes of phosphorus is exemplified in their irritating effect upon the broncho-pulmonary mucous membrane. Toxic symptoms are often accompanied by serious disturbances, respiratory failure being

among the immediate causes of death have no marked action on the functions of the liver.

Liver, Bones, and Metabolism.—The action of phosphorus is exerted upon the cells of the liver. Its corrosive effects, may be said to be enhanced by the doses it probably induces a specific action on the functions of the liver are enhanced. The liver is more highly pigmented. Possibilities of phosphorus are dependent on an increase in biliary activity. But phosphorus soon brings about retrograde changes in the liver is associated a certain loss in the function of the organ. The production of ammonia is found in the excreta, and the presence of phosphorus in the blood and tissues, seem to show that this is induced in the liver cells by this direct action. The engorgement of the organ, mechanical obstruction of the bile formed, and degeneration takes place, either as a result of the capacity of the liver, or as a consequence of metabolic disturbances occur, which cause general fatty degenerations caused by phosphorus poisoning.

The bones also are the site of action. This consists largely in the formation of new bone-forming cells, by which they are in the process of ossification. Irritation leads very readily to death by necrosis.

Kidneys.—Phosphorus irritates the kidneys, and causes albuminuria; fatty casts and blood in the urine. The urine is increased in quantity. Diminution of urine and anuria, and the presence of blood and other substances found in the urine, are characteristic of phosphorus poisoning.

Absorption and Elimination.—The absorption of phosphorus is a matter of some dispute. It is believed that much phosphorus be ingested it is absorbed. Probably a portion of the drug undergoes oxidation in the stomach and the phosphoric acid formed, enters the blood as phosphates. A part of the phosphorus is present in the fats and oils present in the circulation as elementary phosphorus.

Temperature.—Owing to capillary dilatation the temperature is at first slightly raised. Evaporation and radiation contribute to thermal reduction.

Eye.—In chronic poisoning from phosphorus there are patches of degeneration in the retina. The ophthalmoscopic picture resembles that of retinitis.

Under medicinal doses no special effects upon the eye are reported, although, as has been stated, the vapor of phosphorus is highly irritant to the conjunctivæ.

Uterus.—The action of phosphorus tends to increase the menstrual flow.

Untoward Action.—Small doses produce in some individuals severe gastric disturbance, and in rare cases diarrhea, tenesmus, and jaundice. The fatty degeneration of the retinal capillaries, just mentioned—such as results from chronic intoxication affecting workers in match-factories—is an untoward manifestation to be guarded against by every available means.

Poisoning.—The effects of a fatal dose of phosphorus are not immediate. Indeed, as shown by Kionka, large doses of phosphorus may be ingested without any poisonous symptoms, but if the drug is finely divided poisonous symptoms occur. In some patients a rapid onset, thirty minutes to four hours, has been observed. Nausea, vomiting, heart weakness and coma are rapidly followed by death. This type of poisoning is occasionally observed from the use of certain abortion pills sold usually by the Chinese. In the majority of instances the protracted gastro-enteric form of poisoning occurs.

In these forms the acute symptoms subside, and the hope is raised that the patient will recover, but after a lapse of several hours or even two to three days, the symptoms of the acute stage may recur. There is great weakness, accompanied in a large majority of cases by vomiting. Abdominal pains follow, the symptoms becoming more acute, mucus and bile being present in the dejecta, which for a while retain the odor and luminosity of phosphorus. With the cessation of vomiting pain is abated, although it may extend over the entire abdominal region and even be attended with paroxysms.

The foregoing symptoms are accompanied by pronounced anorexia, thirst and fever, a thickly coated or whitish tongue, burning in the throat, and often signs of collapse. The temperature at first may be high, it subsequently sinks below the normal. After thirty-six hours or more jaundice sets in. The liver is usually swollen, and tender to pressure. The urine is diminished, becoming charged with albumin and urates, and even bloody, containing among other ingredients biliary acids and coloring-matter. In fatal cases urea is almost wholly wanting. The stools may be normal, but the general condition is usually marked by diarrhea or constipation and flatulence. Hemorrhage often occurs, wounds bleeding profusely, and as the severity of the symptoms increases delirium ensues, or coma terminating in convulsions.

Serious nervous manifestations are frequently preceded by restlessness, insomnia, headache, and vertigo. In some delirious conditions wild, erotic states of the mind are the precursors of convulsive or comatose symptoms. Somnolence is not uncommon, with partial spasms and contraction or paresis of the voluntary muscles.

In cases of acute poisoning the greatly, death occurring at times with deferred for a few weeks. As a elimination of the drug requiring to given as the lethal dose: $\frac{1}{2}$ grain (0.0 grain has given severe symptoms.

Postmortem examination shows the muscles, capillaries, and arterioles effects of the poisoning, and are under

The symptoms of *chronic poisoning* are especially marked, inhalation of phosphorus in pronounced conditions of necrosis, illary, although it has been maintained that poisoning is contingent upon denuded surface or softening of tissues, caries of the teeth. Very rarely the palate and frontal bone

Treatment of Poisoning.—Emetic first necessary. Copper sulphate is the best chemical antidote. Hydrated lime water have been suggested, yet a more efficient antidote is desirable. Physiological agents have been employed to the drug, among them old acid (oxygen) potassium permanganate in a $\frac{1}{2}$ pint used as a stimulant to the heart. Cathartics, such as castor oil, or oil of turpentine, should be avoided. Some toxicologists teach

As prophylactic measures for the phosphor-necrosis, masks covering the face, found serviceable, as well as inhalation obtained by suspending a small bottle. The teeth should be kept constantly clean, favors the tendency to necrosis.

Therapeutics.—Phosphorus is normally it is a tonic, especially of the stimulating protoplasmic activity. "phosphorus is a rapid stimulant, but not by increasing power; it improves it momentarily galvanizes, as it were, incapable of renewing a dilapidated system exhausted by chronic disease.

Clinical experience has certainly shown it a nutrient tonic to the nervous and osseous system, and *chronic nervous exhaustion* it is relieved of *neuralgia*, particularly of the fifth nerve. great debility, may be relieved by rest for four hours.

It is claimed by some observers that the teeth have been completely relieved by phosphorus.

It has proved of great value in caries, delayed resolution of bone, *osteomalacia*, and *rachitis*, and the drug is credited with the cure of *pernicious anemia*, though it is singular, if the drug possesses any real value in this disease, that the fact has been recognized by so few observers. Such able men as Fox and Broadbent praise its efficacy in *lymphadenoma*. It possesses some value in the *inflammation of the aged* and the *weakfulness of cerebral anemia*. Phosphorus is also a valuable remedy in *functional impotence*.

Administration.—Since many persons have a peculiar susceptibility to phosphorus, its administration should begin with small doses, and, should it be thought necessary to prolong the administration for an indefinite period, the tendency of the drug to produce general steatosis should not be forgotten.

The phosphorus pill is undoubtedly the best form in which to administer the drug, though it possesses the disadvantages of being insoluble in the intestinal fluids and of producing more or less irritation of the gastro-intestinal mucous membrane. This latter effect is usually unnoticed under ordinary medicinal dosage on a full stomach. The liquid preparations of phosphorus are more unstable, rapidly tending to become inert by oxidation.

Official Derivatives.

Calcium Hypophosphite—**Calcium Hypophosphitis**—**Calcium Hypophosphite** (CaS_2P_2)—*Official*—Obtained by heating phosphorus with milk of lime and exposing the mixture to the air.

Description and Properties.—Colorless, transparent, noncrystalline pyramids, or small, lustrous scales, or a white, crystalline powder, odorless, having a nauseous, bitter taste, and persistent in the air. Soluble in 65 parts of water and in 1 part of boiling water; insoluble in alcohol. It should contain not less than 90 per cent. of pure calcium hypophosphite.

Dose, 5 to 10 grains (0.3 to 0.6 gm.) (7½ grains 0.5 gm.), U. S. P.

Calcium Phosphas Precipitatus—**Calcium Phosphatis Precipitatus**—**Precipitated Calcium Phosphate** ($\text{Ca}_3(\text{PO}_4)_2$)—*Official*—Prepared by the action of acetic acid and water upon bone ash, the addition of water of ammonia to render the mixture of an alkaline reaction, and washing and drying the precipitate. It should contain not less than 90 per cent. of pure calcium phosphate.

Description and Properties.—A light white, amorphous powder, odorous and tasteless, formed in the air. Almost insoluble in cold water; partly dissolved by boiling water, which dissolves out an acid salt; almost insoluble in acetic acid, even when freshly precipitated, easily soluble in hydrochloric or nitric acid; insoluble in alcohol.

Dose, 10 to 20 grains (0.6 to 1.3 gm.) (15 grains 1 gm.), U. S. P.

Sodium Hypophosphite—**Sodii Hypophosphitis**—**Sodium Hypophosphite** ($\text{Na}_2\text{S}_2\text{P}_2$)—*Official*—Prepared by adding sodium carbonate to a solution of calcium hypophosphite and evaporating the filtrate. It should contain not less than 90 per cent. of pure sodium hypophosphite.

Description and Properties.—Small, colorless, transparent, rectangular plates of a prismatic habit, or a white granular powder, odorous and having a bitter-sour, saline taste. Very deliquescent on exposure to moist air. Soluble in 1 part of water and in 1 part of alcohol; insoluble in 1 part of boiling water and in 1 part of boiling alcohol; slightly soluble in alcohol; insoluble in ether. Sodium hypophosphite should be kept in well-stoppered bottles.

Dose, 5 to 10 grains (0.3 to 0.6 gm.) (15 grains 1 gm.), U. S. P.

Potassium Hypophosphite—**Potassii Hypophosphitis**—**Potassium Hypophosphite** ($\text{K}_2\text{S}_2\text{P}_2$)—*Official*—Prepared by passing in a stream of ammonia gas into a solution of calcium hypophosphite, or by adding potassium carbonate to a solution of calcium hypophosphite. It should contain not less than 90 per cent. of pure potassium hypophosphite.

Description and Properties.—White, opaque, or a granular powder, odorless, and having a pH soluble in 0.6 part of water and in 7.3 parts should be kept in well stoppered bottles.

Dose. 5–30 grains (0.3–2.0 Gm.) [7½ grains]

Acidum Hypophosphoræum—Acid. Hyphosphoricum (U. S. P.)—*Definition.*—Aqueous solution of absolute hypophosphorous acid and 10 per cent.

Description and Properties.—A colorless, odorless liquid in proportions with water. It is a powerful reducer from solutions of silver nitrate, calomel from or with copper sulphate a yellow precipitate of copper phosphorous acid. It is used in the preparation of dilutum.

Incompatibles.—Incompatible with arsenical that are more or less easily reduced.

Acidum Hypophosphoræum Dilutum—Diluted Hypophosphorous Acid (U. S. P.) 10 per cent. by weight of absolute hypophosphoric

Description and Properties.—A colorless liquid with a taste. Specific gravity about 1.042. Miscible with

Dose.—It is rarely used as a therapeutic agent hypophosphites [8 minims (5 Cc.), U. S. P.]

Syrupus Hypophosphitum—Syrupus Hypophosphitum.—*Formula.*—Calcium hypophosphite, 15; diluted hypophosphoric acid, 5; sugar, 650. Sufficient water to make 1 fluidounce (30 Cc.).

Syrupus Hypophosphitum Compositus—Compound Syrup of Hypophosphites.—*Formula.*—U. S. P., 1890 is dropped, but iron, as ferric hypophosphite 0.25 per cent. It contains iron and manganese hypophosphites, hypophosphoric acid. It is adopted from the National Formulary and proprietary preparations.

Dose.—Average dose: 2 fluidrams (8 Cc.).

Elisir Færræ, Quininx et Strychninx Phosphatæ—Elixir of Iron, Quinine, and Strychnine Phosphate (U. S. P.)—Each fluidram contains 1 grain (0.0324 Gm.) of quinine, and ½ grain (0.0076 Gm.) of strychnine, and is representative of a large class of popular preparations.

Dose.—Average dose: 1 fluidram (4 Cc.).

Glyceritum Færræ, Quininx et Strychninx Phosphatæ—Oleum Færræ, Quininx et Strychninx Phosphatæ (U. S. P.)—This is one of the popular and useful combinations of the many proprietary preparations, it is the formula (see U. S. P. i., whereas the latter is the formula of the different manufacturers (See Quinine Phosphatum). This glycerite is a stable and from which the syrup of the phosphate readily be prepared.

Dose.—Average dose: 15 minims (1 Cc. (0.080 Gm. — 80 milligrammes) of soluble ferric phosphate, 104 milligrammes) of quinine, and ½ grain (0.0076 Gm.) of strychnine. The ratio of quinine to strychnine is four to

Antagonists and Incompatible. hypophosphites are incompatible with silver, and the soluble phosphate compatible with calcium hypophosphite.

Synergists.—Phosphorus, cod-liver oil, generally.

Physiological Action.—Although not possessing the active and poisonous properties of phosphorus, the HYPOPHOSPHITES are useful as tonic stimulants, being particularly valuable in general furunculosis.

The CALCIUM PHOSPHATE adds the action of calcium to that of the hypophosphite.

The ZINC PHOSPHIDE is more active. In this preparation the zinc ion plays an important part.

Therapeutics.—*Externally and Locally.*—The CALCIUM PHOSPHATE, combined with a little free phosphoric acid, has been recommended by Doubenski in the treatment of *tuberculous ulcers*. "Cold abscesses and fistulous tracts were treated by packing with gauze soaked with a solution of 5 parts to 100."

Internally.—The HYPOPHOSPHITES are useful as general tonics. Phosphoric acid has little action as determined by animal experimentation, but negative evidence from such research has no bearing, in view of much positive evidence derived from clinical use. In *chlorosis*, *anemia*, *scorbuta*, and *tuberculi* they have been highly recommended. In the opinion of many the benefit derived from their use in the cachexia mentioned is slight compared with that of cod-liver oil and the hygienic influences rendered serviceable in these conditions.

Administration.—The zinc phosphide is best given in pill form. The hypophosphites and calcium phosphate may be given in capsules though the syrup of the hypophosphites is usually preferred. In patients who cannot take sugar, even in small quantities, the syrup may be contraindicated.

ARSENIC.

Arseni Trioxidum—Arseni Trioxidi—Arsenic Trioxide. U. S. P.

ACTION ARSENICI. U. S. P. 1890.

Origin.—Arsenic has been found in minute quantities in many natural waters. It is obtained in large quantities by heating arsenical minerals, and is purified by sublimation. The pure arsenic is a white crystalline solid, containing 66 per cent. of arsenic trioxide.

Description and Properties.—It is a heavy white crystalline solid, as an oxide, white powder of a fine granular texture of the very finest kind, amorphous, transparent, and colorless. It gives the usual arsenical reaction in many reactions, particularly in the glass reaction. It is insoluble in water, alcohol, ether, and most organic solvents. It is soluble in strong acids, and in strong alkalis. It is soluble in concentrated nitric acid, and in concentrated sulfuric acid.

When arsenic trioxide is very finely divided in cold water the suspension remains about 20 to 30 days before it settles. 100 parts of water will hold 1.25 parts of arsenic trioxide. It is completely soluble in 15 parts of boiling water. Arsenic trioxide is the active ingredient in the glass reaction, and in the arsenical reaction. It is soluble in strong acids, and in strong alkalis. It is soluble in concentrated nitric acid, and in concentrated sulfuric acid.

Dose.— $\frac{1}{10}$ to $\frac{1}{5}$ grain (0.001 to 0.025 Gm.) ($\frac{1}{10}$ grain or 2 Gm.), U. S. P.]

Official Preparation

Liquor Acidi Arsenosi—Liquoris Acidi Arsenici.—Strength, 1 per cent. of arsenic trioxide.

Description and Properties.—A clear, colorless taste and an acid reaction.

Dose.—2-10 minims (0.12-0.6 Cc.) [3 minims]

Liquor Potassii Arsenitis—Liquoris Potassii Arsenici.—Strength, 1 per cent.

Dose.—2-10 minims (0.12-0.6 Cc.) [3 minims]

Ärseni Iōdidum—Ärseni Iōd**U. S. P.**

Origin.—Prepared by triturating in a mortar iodine until they are thoroughly mixed, or by mixing iodine with potassium iodide, and evaporating. It should contain 2 per cent. of metallic arsenic.

Description and Properties.—Glossy shining, orange-red, crystalline scales, having an iodine odor on exposure to air and light. Soluble in 28 parts of alcohol. Arsenic iodide should be kept in a dark place, protected from light.

Dose.— $\frac{1}{12}$ — $\frac{1}{8}$ grain (0.002-0.008 Gm.) [$\frac{1}{16}$ grain]

Official Preparation

Liquor Ärseni et Hydrärgyri Iōdidi—Liquor Ärseni et Hydrärgyri Iōdidi.

—Solution of Arsenic and Mercuric Iodide—2 per cent., each, arsenic iodide and mercuric iodide.

Description and Properties.—A clear, pale-yellow liquid, having a disagreeable metallic taste.

Dose.—1-10 minims (0.06-0.6 Cc.) [4 minims]

Sōdii Ärsenas—Sōdii Ärsenāt**U. S. P.**

Origin.—Prepared by heating to redness arsenic trioxide. Dissolve the fused mass in water and recrystallize. It should contain not less than 98 per cent. of orthoarsenate.

Description and Properties.—Colorless, and having a mild, alkaline taste (the salt is deliquescent in moist air, and somewhat deliquescent in moist air). Soluble in boiling water, and slightly soluble in cold water. Sodium arsenate should be kept in a dry place.

Dose.— $\frac{1}{12}$ — $\frac{1}{8}$ grain (0.001-0.006 Gm.) [$\frac{1}{16}$ grain]

Sōdii Ärsenas Exsiccātus—Sōdii Ärsenāt**—Exsiccated Sodium Arsenate**

(Also known as ANHYDROUS)

Description and Properties.—Anhydrous sodium arsenate. Permanent in dry air. Soluble in water.

This is prepared from sodium arsenate by drying in water of the latter. The hydrous sodium arsenate is permanent in dry air and somewhat deliquescent in moist air. The new preparation is somewhat uncertain. The new preparation of sodium arsenate contains 40.4 per cent. of water;

will contain but little more than half as much arsenic as an equal weight of the raw cated. The average dose of the latter is accordingly placed at about one-half that of the former.

Dose.—Average dose: $\frac{1}{2}$ grain (0.003 Gm. = 3 milligrammes), U. S. P.

Official Preparation.

Liquor Sodii Arsenatis—**Liquoris Sodii Arsenatis**—**Solution of Sodium Arsenate** (PARKSON'S SOLUTION).—Strength, 1 per cent. (1 sodium arsenate).

Dose. 1 to 10 minims (0.06–0.6 Cc.) [3 minims (0.2 Cc.), U. S. P.]

Antagonists and Incompatibles.—Arsenic is incompatible with the salts of iron, silver, magnesia, lime, copper, ammonium, and with vegetable astringents.

Synergists.—Iron and general tonics are synergistic to arsenic.

Physiological Action.—*Externally and Locally*.—Arsenic itself is largely inert. It is partially oxidized, however, particularly in the intestinal canal, and the arsenous acid ion H_2AsO_3 , and the anhydride, As_2O_3 , are converted into arsenites and are active. Applied to the skin, arsenic acts as a caustic, exciting violent inflammation. Its escharotic influence results in destruction of vitality in the affected parts, accompanied with sloughing. Arsenic may be absorbed from the unbroken skin. Skin eruptions are frequent under arsenical applications.

Internally—Digestive System.—Except in exceedingly small doses arsenic acts as a gastro-intestinal irritant. Minute and medicinal doses stimulate the flow of gastric and intestinal juices, and augment peristalsis, improving the digestive and nutritive functions. When too long continued, the drug produces nausea, diarrhea, and increased micturition, with a sensation of heat and dryness of the throat and stomach. Toxic doses are followed by violent gastro-enteritis. Indeed, in whatever manner introduced into the system, arsenic has a marked action upon the gastro-intestinal tract, causing vascular changes, in the nature of dilatation of the capillaries, which when prolonged bring about destructive lesions. (See Chronic Poisoning.)

Circulatory System.—Cardiac action may be slightly stimulated by small doses, the experience of arsenic eaters proving that the drug, so far from being necessarily deleterious, actually tends to invigorate the heart action for a time at least. Large doses render the heart irritable and feeble.

On the blood-making organs, arsenic has a distinct action, though as yet not definitely understood. New-formed blood-cells have been found, and the spleen and long bones seem to be stimulated to increased blood-making activity. Arsenic in its relations to chronic poisoning shows itself to have a destructive action on the minute blood-vessels. It seems, in common with many other substances, to increase the clotting properties of the blood-serum. Capillary thrombi are constant features of chronic toxemia.

Nervous System.—The general effect of arsenic upon the brain and nervous system is that of a tonic. The cerebral functions are somewhat stimulated.

The grade of stimulation caused mine, as other factors, notably its should be borne in mind. In ch very minute doses, the nervous sy ticularly the peripheral nerves, bot

Under prolonged use arsenic b extent in nervous than in other Scolosuboff, if 1 part is found in the liver is 10.8; in the brain, 36.5

Respiratory System.—Ordinary a in respiration other than increased respiratory center. It has been l doses stimulate the peripheral endi toxic doses arsenic acts as a power

Absorption and Elimination.—t the blood. Its presence has also b urine, sweat, the bronchial and int even in the parenchymatous tissu the body by the intestines, and also, by the bile and the skin. tears are said to share in the proce

Medicinal doses prevent tissue crease nitrogenous metamorphosis. tainly to modify and improve nuti novel idea that the main activity oxidizing properties by which arse acid, which in turn is reduced to alternating oxidation and reduction ting general metabolic activity.

Temperature.—The temperature Chronic intoxication may be accor

Ecz..—Large doses, or small c injection of the conjunctivæ, ecze the lids. This is a manifestation the capillaries of the gastro-intesti

Untoward Action.—Differing fro of poisoning occasionally produc susceptible persons, there are ind ness, headache, alopecia areata, bro of digestion, thirst, coryza, and, ic disia, icterus, lacrimation, photoph various cutaneous eruptions, frequ

An eruption resembling that c (0.18 Cc.) of Fowler's solution, i *Times and Gazette*, 1868). Falck produced a discolored sanguinol swelling Papules and erythema observed.

"Eruptions petechial or ecchym

erysipelatous, pustular—such are the principal forms of arsenical exanthemata," described by Imbert-Gourbevre.

Poisoning.—Large doses of arsenic taken in the form of rat poisons, fly papers, dyes, and parasiticides (Scheele's and Paris green) produce symptoms of *acute poisoning*, the drug almost immediately manifesting its characteristic effects upon the gastrointestinal canal (to which it is a marked irritant), exciting active inflammation. There are, in from fifteen minutes to one-half hour, colicky pains in the stomach, nausea, vomiting, looseness of the bowels, and edema of the face, indicated by puffiness under the eyelids. The passages are at length similar to the "rice-water" discharges of cholera, although different from the latter in the presence of blood or serum. The purging becomes obstinate and exhausting. In certain cases other choleraic symptoms are especially manifested, as increasing coldness of the body, and cramps.

There is great prostration, pinched, bloodless face, fall in blood-pressure, the urine is scanty or suppressed, headache, collapse. Death may supervene in from one to four hours with small pulse and sighing respiration. Sometimes the patient recovers from the acute attack, and subsequently dies in from two to three days from the secondary degeneration, as in phosphorus poisoning. As a minimum lethal dose, 1 grain (0.065 Gm.) of arsenious acid may be mentioned as having caused death, though much larger doses have been recovered from.

Chronic Poisoning.—This may arise from a great variety of sources. In some localities by some peoples, as in Styria, large doses are tolerated for considerable periods of time, apparently with not markedly pernicious effects. Undoubtedly, much of the fame of the arsenic eaters' good health is fictitious, but the clinical evidence goes to show that a tolerance for arsenic may be established.

In chronic poisoning, which may arise from the absorption of very minute amounts of arsenic from earths, food, fruit sprays, paints, wall-paper, carpets (dyed with arsenic dyes) beer (arsenic from glucose, from sulphuric acid), the symptoms may be in (1) Intestinal tract—anorexia, nausea, sometimes vomiting, occasional diarrhea, pain. (2) Mucous membranes of eye, nose, throat, as coryza, sneezing, conjunctivitis, puffiness of eyelids. (3) Skin—as eruptions, pigmentation, herpes, increased growth of hair and nails. (4) Nervous system as paresthesia followed by peripheral neuritis of arms or legs, or both, neuralgic pains usually accompanying. In terminal stages, mental symptoms, as dementia, with convulsive seizures, etc., may develop.

Treatment of Poisoning.—In the acute poisoning it is necessary that treatment be expeditious and the agents and methods adopted carefully chosen. Vomiting often renders the use of the stomach-pump unnecessary, yet emetics are frequently serviceable, the cleansing of the stomach being of primary importance. Various antidotes have been successfully used, the best, chemically, being

freshly prepared hydrated sesquioxide of water, 2 or 3 tablespoonfuls every 4 hours. Magnesia, chalk, and lime-water also may be given. The temperature of the patient should be kept normal. (oil, milk, etc.) freely given, include mucilaginous drinks, opiates in case of necessity, stimulants. Activated charcoal, etc., may be useful to overcome

In the chronic poisoning, withdrawal of the drug and symptomatic treatment is indicated.

Therapeutics.—*Externally* and *locally* arsenic is as an escharotic. It is used to destroy malignant growths, such as *multiple sarcomatous degeneration*, and in the latter affection the parenchyma of the skin. (0.3 Cc.) of Fowler's solution, diluted with distilled water, is used.

Many of the pastes and "quacks" are based on their efficiency to arsenic. Manec's (1.0 Gm.); black sulphur (1.0 Gm.); burnt sponge, 35 grains (2.3 Gm.);

The noted *poudre caustique de Fowler* is a similar preparation, containing about 1.0 Gm.

The solution of arsenous acid is used to treat *warts* and *corns*. If these grow too large their removal may be facilitated by the solution of *potassa*. When used over the skin it may be applied in good strength and inflammation may be excited and the danger of

Internally.—Arsenic is a peculiarly effective in *scaly skin diseases*.

Like all other alteratives, it is more effective in nature more favorably than acute diseases. This drug, the remedies in *psoriasis*, *lepra*, and *chronic*

Pemphigus, *prurigo*, *acne*, and *lichen* are greatly influenced by the continued action. In the successful management of these diseases it is necessary that the preparation be given in as large doses as can be tolerated and continued unremittingly for a long time.

Lymphoma, whether superficial or deep, is frequently benefited greatly by

Asthma and *bronchitis*, whether acute or chronic, or succeeding scaly skin diseases, are benefited by arsenic medicine when the dose is carried to the limit. Another condition, *dysmenorrhea*, from a tendency to asthma or subject to asthma is often cured or greatly benefited by

The obstinate and often incurable disease known as *pernicious anemia* yields better to arsenic than to any other known remedy.

The statements in the preceding paragraph apply also to *leukemia*, whether *splenic*, *myelogenic*, or *lymphatic*, and to *Hodgkin's disease*.

Arsenic is valuable in the treatment of *malaria*, particularly in the chronic cachectic types. The *modus operandi* is not yet known. It may be a protozoa poison, or it may increase certain protective properties of the blood-sera. It may have an action on the spleen.

The *neuralgias*, *anemia*, and *headache* of malarial origin are singularly amenable to this medicine.

Fowler first reported the remarkable efficacy of arsenic in *neuralgia of the intercostal and fifth pair of nerves*. It is equally valuable in these cases whether the disease be due to malaria or to general debility.

If this drug is specific in any one disease, it is so in *chorea*, very rarely failing to effect a cure when judiciously administered. It should be given in full doses, and increased as tolerance is established.

This medicine seems to act equally well in *gastralgia*. It is also an efficient remedy in *gastritis* or the vomiting of gastritis, especially in that occasioned by the excessive use of alcohol. Many *irritative conditions of the stomach* are relieved by minute doses of Fowler's solution. Excessive peristalsis, resulting in *diarrhea*, coming on immediately after taking food, is usually cured completely by very small doses of Fowler's solution alone or combined with an equal quantity of tincture of opium. Arsenic has also been recommended in *gastric ulcer* and *cancer*.

It has proved of great service in *hysteria*, *spasmodic asthma*, and *acute coryza*. It is often very serviceable in *catharrhal pneumonia* and in *chronic bronchitis*. Arsenic is useful in *diabetes mellitus*. *Rheumatoid arthritis* is more favorably influenced by the use of arsenic than by any other medicine. It should be employed in the treatment of *chronic rheumatism*. Even in *secondary syphilis* a combination of mercury and arsenic has produced better results, in some cases, than mercury alone. Ansie has recommended arsenic in *angina pectoris*, alleging that it mitigates the severity of the attacks. *Chronic diarrhea*, when induced by intestinal fermentation or chronic malarial infection, is sometimes greatly benefited by this drug.

Finally, arsenic is a valuable adjunct to iron in the treatment of *simple anemia* and *chlorosis*.

Contraindications—In acute skin diseases and pulmonary tuberculosis with a tendency to hemoptysis.

Administration—Arsenic should be given ordinarily after meals. There are certain conditions, however, requiring its administration in small doses before meals. When it is desired to give arsenic in pill form, the trioxide should be used, and for solutions the liquor potassii arsenicis is usually preferred.

In syphilitic disorders Donovan's is the ration to use.

Children are much less susceptible, often being able to take adult doses.

During a course of arsenic the patient should watch carefully for the first untoward effects, such as redness about the eyes, itching of the skin, or numbness of the fingers. Any such indication that the dose should not be continued is necessary to lessen the dose, or even to discontinue altogether, for a while.

There are two methods of getting the influence of the drug:

1. Begin with a full dose of Fowler's solution (0.06 Cc.) a day until a marked effect is then repeat the method.

2. Begin with a small dose of 1 minim (0.06 Cc.) a day until a marked effect the dose has reached 10 to 15 minims then repeat the method or decrease the dose a day.

Cacodylates.—Organic compounds of arsenic act much more slowly and less accurately than the salts. Such compounds are cacodylates, which have been introduced recently, first suggested by Schmidt in 1869. These bodies are non-irritating, but clinical experience would seem to show that arsenic can be taken as cacodylates. The indications are the same as those for arsenic. Dosage, $\frac{1}{4}$ –1 grain. Renz in 1865 gave doses of from 10 to 18 grains of cacodylate and maintained that the hypodermic use of these results in better results than when they are given by the mouth.

Hydrargyrum -Hydrargyrum

(QUICKSILVER)

Origin.—The knowledge of this drug is ancient, in Spain, Austria, Peru, and China, but is of recent origin in California. It occurs to some extent in the large globules; also in combination with oxygen in the principal ore from which it is extracted is cinnabar.

Description and Properties.—A silvery white metal with a blue tinge. It is liquid at the ordinary temperature; but when cooled to -39° C. (-32° F.) it becomes a solid mass. Specific gravity, 13.535 at 25° C.

Insoluble in the ordinary solvents, also in water at common temperatures, in sulphuric acid, but dissolves in nitric acid, and readily and completely soluble in nitric acid in well-stoppered bottles.

Dose.—Mercury is seldom given internally in pill.

Official Derivatives.

Hydrargyrum Ammoniatum—Hydrargyri Ammoniatum—Ammoniated Mercury (U. S. P.)—*Origin*.—Prepared by mixing solutions of ammonia and corrosive mercuric chloride. Filter and wash the precipitated ammoniated mercury. It should contain not less than 75 per cent., nor more than 80 per cent., of metallic mercury.

Description and Properties.—White pulverulent powder or white, amorphous powder without odor, and having an earthy, and afterward soapy and metallic taste. Permanent in the air. Almost insoluble in water or in alcohol. It should be kept in well stoppered bottles, protected from the light. Used externally.

Unguentum Hydrargyri Ammoniatum—Unguenti Hydrargyri Ammoniatum—Ointment of Ammoniated Mercury—*Formula*.—Ammoniated mercury, 20; white petrolatum 50; hydrocous wool fat, 40. For external use.

Hydrargyrum cum Crêta—Hydrargyri cum Crêta—Mercury with Chalk (U. S. P.)—*Origin*.—Obtained by intimation of mercury, prepared chalk, clarified honey, and water.

Description and Properties.—A light gray, rather damp powder free from granules without odor, and having a slightly sweetish taste. It contains 98 per cent. of mercury. This preparation should be kept in well stoppered bottles, protected from light.

Dose, 3-10 grains (0.15-0.6 Gm.) [4 grains 0.25 Gm. (U. S. P.)]

Massa Hydrargyri—Masse Hydrargyri—Mass of Mercury (U. S. P.)—*Formula*.—Hydrocous wool fat 1; a Mass. Black Pill 1.—Composed of mercury, glycer, olive oil, glycer, and honey of rose.

Dose, 5 to 10 grains (0.3-0.6 Gm.) [4 grains 0.25 Gm. (U. S. P.)]

Unguentum Hydrargyri—Unguenti Hydrargyri—Mercurial Ointment (U. S. P.)—*Composition*.—Mercury, 12; suet, and oleate of mercury. Used externally.

Unguentum Hydrargyri Dilutum—Unguenti Hydrargyri Diluti—Blue Ointment (U. S. P.)—This preparation contains 50 per cent. of unguentum hydrargyri, which is called mercurial ointment. Heretofore "Blue Ointment" and "Mercurial Ointment" have been synonymous. Mercurial ointment contains about 50 per cent. of metallic mercury, while the ointment contains about 33 1/3 per cent.

Emplastrum Hydrargyri—Emplastrum Hydrargyri—Mercurial Plaster (U. S. P.)—*Composition*.—Mercury, oleate of mercury, hydrocous wool fat, and lead plaster. Used externally.

Hydrargyri Chloridum Corrosivum—Hydrargyri Chloridi Corrosivi—Corrosive Mercuric Chloride (U. S. P.)—*Origin*.—A mixture of Mercuric Chloride and Nitrogen Trichloride. Prepared by heating a mixture of these compounds, mercuric chloride, and nitrogen trichloride. The corrosive chloride contains one or two grains. It should contain not less than 99.5 per cent. of pure mercuric chloride.

Description and Properties.—Heavy, colorless, rhombic crystals or crystals in masses colorless and having an acrid and persistent metallic taste. Permanent in the air. Soluble in 13 parts of water, in 3 parts of alcohol, in 2 parts of boiling water, or in 2 parts of strong alcohol, in 4 parts of ether, and in about 14 parts of glycerin. It should be kept in well stoppered bottles.

Dose, 1/4 grain (0.005 Gm.)—*Contraindication*, [4 grains 0.25 Gm. (U. S. P.)]

Hydrargyri Chloridum Mille—Hydrargyri Chloridi Mille—Mild Mercurous Chloride (U. S. P.)—*Formula*.—Mild Chloride of Mercury. Prepared by dissolving mercurous chloride, mercury, potassium chloride, and boiling distilled water. Stirring and wash the sublimed residue with boiling distilled water. It should contain not less than 99.5 per cent. of pure mercurous chloride.

Description and Properties.—A white, impalpable powder forming a yellowish color on being triturated with strong pressure. It is soluble in dilute acids, permanent in the air. Insoluble in water, alcohol, or ether, and almost insoluble in oil. When strongly heated, it is wholly volatilized, without melting. It should be kept in dark, airtight, sealed bottles.

Dose, 1/10 grain (0.002 Gm.)—*Contraindication*, [1/2 grain 0.025 Gm. (U. S. P.)]

Pilule Cathartice Compositæ—Pilule Compositæ Cathartice—Compound Cathartic Pills—*Formula*.—

Hydrargyri Iodidum Flavum—Hydrargyri Iodidi Flavum—Yellow Mercurous Iodide (U. S. P.)—*Formula*.—Hydrocous wool fat 1; a Mass. Black Pill 1. Prepared by mixing ammoniated potassium iodide and mercurous nitrate with nitric acid and distilled water. The pre-

precipitate is washed and dried. It should contain not less than 95 per cent. of mercurous iodide.

Description and Properties.—A bright-yellow, tasteless. By exposure to light it becomes dark brown and is converted into metallic mercury and mercuric iodide, which is wholly insoluble in alcohol or ether. It should be protected from the least possible exposure to light.

Dose.— $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.01–0.03 Gm.) [$\frac{1}{4}$ grain Hydrargyri Iodidum Rubrum Hydrargyri Iodide (U. S. P.) (BINIODIDE OF MERCURY) = $\frac{1}{2}$ grain]. Prepared by mixing solutions of corrosive sublimate and potassium iodide, and drying the precipitated red iodide. It should contain not less than 95 per cent. of mercuric iodide.

Description and Properties.—A scarlet-red, tasteless; permanent in the air. Almost insoluble in alcohol. It should be kept in well-stoppered bottles.

Dose.— $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.002–0.004 Gm.) [$\frac{1}{4}$ grain Liquor Arseni et Hydrargyri Iodidi = $\frac{1}{2}$ grain]. —Solution of Arsenic and Mercuric Iodide (U. S. P.) (Liquor Arseni et Hydrargyri Iodidi) = $\frac{1}{2}$ grain (0.3 Cc.), gradually increased.

Hydrargyri Oxidum Flavum—Hydrargyri Oxide (U. S. P.) (*Origin*)—Prepared by precipitating mercuric chloride with soda. It should contain not less than 95 per cent. of mercuric oxide.

Description and Properties.—A light orange powder; odorless, and having a somewhat metallic taste; turning darker on exposure to light. Almost insoluble in water. It should be kept in well-stoppered bottles, protected from light.

Unguentum Hydrargyri Oxidi Flavum—Ointment of Yellow Mercuric Oxide.—Formula: Hydrargyri Oxidum Flavum, 40; petrolatum, 60; water, 10; hydrous wool-fat, 40; petrolatum, 10.

Hydrargyri Oxidum Rubrum—Hydrargyri Oxide (U. S. P.) (RED PRECIPITATE)—*Origin*—Prepared by precipitating mercuric nitrate with hydrous wool-fat. Evaporate to dryness. It should contain not less than 95 per cent. of mercuric oxide.

Description and Properties.—Heavy, orange powder, becoming yellower the finer it is divided. It has a metallic taste; permanent in the air. Almost insoluble in water. It should be kept in well-stoppered bottles, protected from light.

Dose.— $\frac{1}{4}$ – $\frac{1}{2}$ grain (0.001–0.006 Gm.).

Unguentum Hydrargyri Oxidi Rubri—Ointment of Red Mercuric Oxide.—Formula: Hydrargyri Oxidum Rubrum, 40; petrolatum, 60; hydrous wool-fat, 40; petrolatum, 10.

Liquor Hydrargyri Nitratis—Liquor Mercuric Nitrate (U. S. P.)—A liquid containing mercuric nitrate, together with about 11 per cent. of free nitric acid.

Description and Properties.—A clear, colorless liquid, with a strong odor of nitric acid and a strongly acid reaction. It should be kept in well-stoppered bottles.

Used externally as a caustic.

Unguentum Hydrargyri Nitratis—Ointment of Mercuric Nitrate (U. S. P.) (Citratum)—Formula: Hydrargyri Nitratis, 40; petrolatum, 60; hydrous wool-fat, 40; petrolatum, 10; nitric acid, 175; lard, 760 parts. Used externally as a caustic.

Unofficial Prep

Lotio Flava—Lotio Flava—Yellow Lotions—Formula: Lotio Flava, 10; lime water, 10 ounces (473.17 Cc.).

Lotio Nigra—Lotio Nigra—Black Lotions—Formula: Lotio Nigra, 10; lime water, 10 ounces (473.17 Cc.). For external use.

Asparagin Hydrargyrate—*Dose.*— $\frac{1}{4}$ grain.

Antagonists and Incompatibles.—Mercury with chalk is incompatible with acids and acidulous salts. Calomel is incompatible with alkalies, alkaline earths, alkaline carbonates, iron, lead, copper, iodine, bromides, soaps, sulphhydrates, and nitrohydrochloric acid, as well as hydrochloric acid, potassium, ammonium, and sodium chloride.

Corrosive sublimate is incompatible with alkalies and their carbonates, soap, lime water, tartar emetic, the iodides of potassium and sodium, acetate of lead, silver nitrate, the sulphides, albuminous liquids (as milk, etc.), many vegetable infusions, and compound syrup of sarsaparilla.

In general, metallic preparations of mercury are incompatible with iodine and the chlorides.

Synergists.—Potassium iodide enhances the antisyphilitic action of mercury. Depressants—such as antimony and alkalies—increase the physiological activity of mercury and its preparations.

Tonic and resin-bearing purgatives—such as aloes, rhubarb, and podophyllum—and the cathartic action of some of the mercurial preparations.

Physiological Action.—*Externally and Locally*—Most of the preparations applied to the skin are antiparasiticide and antiseptic, corrosive mercuric chloride being one of the most important antiseptics and universal germicides known.

Some of the mercurials are powerful irritants, the nitrate being an active caustic. The mercurous salts even possess slightly stimulating properties.

Metallic mercury and its salts are readily absorbed with the aid of friction, at times producing a slight irritation resulting from their stimulating properties. Absorption may also take place from local application in the form of a fine vapor.

The introduction of the drug into the system through the medium of the skin is attended with all the symptoms of mercurial poisoning. The local actions of the various preparations differ somewhat, yet they agree in certain physiological effects produced after absorption of the drug.

Locally, on mucous membranes, mercury acts as an astringent or cauterizant, according to the salt used and the grade of concentration. The mercury ion has a marked affinity for albumin coagulating it. The coagulum is usually light and flocculent, and the action of the metal is thus made more penetrating. In contact with mucous membranes an albuminate is formed which is very soluble in an excess of proteid. Thus absorption is rapid.

Internally.—Digestive System.—The action of the soluble and insoluble salts is distinct. The line between physiological action and toxic action is difficult to draw. The soluble salts are, even in minute doses, somewhat astringent or even corrosive. In larger doses they are powerfully exsiccative. The action of soluble salts of mercury is to slightly inhibit the digestive processes. The insoluble salts are slightly irritating and cause increased peristalsis and in-

creased secretions. They have little effect on the heart or vessels.

Circulatory System.—Mercury in small doses, resulting in an increase of red blood cells. In lower animals a pseudo-anemia is produced. Physiological stimulation so that it is associated with cachexia, leucocytosis, and other changes.

Nervous System.—Tonic doses have some erethism, muscular tremor, and precede the development of more distinct changes.

Respiratory System.—Small doses produce no marked respiratory action.

Excretion and Secretion.—The kidneys are irritated by mercury. Diuresis is common.

The absorption of mercury is greater than the fact that every secretion of the body contains it. Its expulsion from the system, its cumulative action, is a well-known fact.

Elimination occurs chiefly by the urine, milk, and feces. Even the semen may be eliminated in twenty-four hours. It is detected in the liver a year after treatment. Mercury has been found in the skin, ulcers. After death the kidneys contain large amounts of the metal.

Untoward Action.—Many effects are observed after the exhibition of mercurials (frequently occurring after the external application of mercurial preparations).

In certain persons having an idiosyncrasy, extreme salivation and stomatitis may be produced by the use or the external application of small quantities.

Medicinal doses may produce, however, disturbances of nutrition, sensation, and reflex action, as to suggest poisoning.

Poisoning.—Although mercury is relatively innocuous, its vapor is capable of producing dangerous symptoms. All the symptoms that are known as corrosive sublimate poisoning. The grades of poisoning by mercurials and idiosyncrasies should not be overlooked. It is divided into the acute and chronic varieties.

Acute Poisoning.—This is not so common at present as in former days, because of the use of the mercury salts. There is a whitish precipitate on the gums, with inflammation of the bloody stomach mucosa are found.

colicky pains are developed with diarrhea, which is often bloody or watery, and with much tenesmus; symptoms of collapse, such as cyanosis, cold skin, small, rapid pulse (140 or over) irregular rapid respiration. Sometimes giddiness, sometimes unconsciousness, may develop. Frequently there is anuria, or bloody and albumin-filled urine. Death occurs usually from shock, and has resulted from $\frac{1}{2}$ grain of corrosive sublimate in one to two hours. Occasionally death takes place after several days with the development of the symptoms of chronic poisoning. A form of rapid poisoning occurs from the inhalation of mercury containing vapors, as in mirror factories. Workers on hat feltings often suffer.

Chronic Poisoning.—This may result from a single dose, but more often from prolonged small dosage, from the breathing of vapors containing mercury. The prodromal symptoms occur in the mouth. They are metallic taste, soreness of teeth, fetid breath, spongy, inflamed gums, and salivation. Discontinuance of the mercury and mouth hygiene usually clears up these symptoms. If, however, dosage is continued or rules of cleanliness neglected, the tongue may become swollen; there is extreme salivation with marked fetor, ulceration and bleeding may take place, and the mouth gets in an abominable condition, with loose teeth or even jaw necrosis. Other concomitant symptoms may develop, such as anorexia, nausea, colic, diarrhea, constipation, sometimes a distinct febrile movement of the temperature (secondary infection). Emaciation, cachexia, motor weakness, restlessness, may come on. There is frequently a fine muscular tremor, and later paresthesiæ, anesthesiæ, and paralysis may develop. Skin eruptions are not infrequent.

Treatment of Poisoning.—In acute poisoning from corrosive sublimate or other active salt of mercury it is necessary to evacuate the stomach as quickly as possible and give white of eggs freely. The after-treatment is similar to that of other corrosive poisons—the use of demulcents and opiates.

For salivation, potassium chlorate probably occupies the first place as a prophylactic and curative agent. It is employed as a gargle and mouth-wash, in a 2 to 3 per cent solution. An astringent wash is frequently necessary. Such drugs as tannin, myrrh, krameria, etc., may be used for this purpose. Where there is extensive ulceration of the mouth, disinfectant and antiseptic solutions will be found desirable.

In cases of chronic mercurial poisoning it is of primary importance to remove all traces of the drug from the body by means of iodides, the dosage being limited in quantity, but continued for some time. A change of air, liberal and nutritious diet, and tonics are also necessary.

Therapeutics.—*Externally and Locally*.—As a germicide, antiseptic, and antiparasitic the preparations of mercury are extremely valuable, the corrosive chloride of mercury being extensively employed as an antiseptic in general surgery in strengths of from

1 : 1000 to 1 : 10,000. It attacks the is not always a reliable germicide.

In *diseases of the skin* due to animals are no drugs so valuable as certain ointment of ammoniated mercury be

CALOMEL in the form of an ointment (Gm) to 1 ounce (32.0 Gm) is an effi

Indolent *venereal ulcers* are mixed with calomel, while the early inflammation may be greatly benefited by the use

Many diseases of the *eye, ear, nose* preparations of mercury. The ointment

MERCURY is particularly adapted to *keratitis, chronic blepharitis marginalis*

Inunction with MERCURIAL OINTMENT is excellent for the constitutional second stages of *syphilis*. These have value in *subacute syngonitis, pelvic cellulitis, epulidymitis*.

The OINTMENT OF THE RED IODINE as an efficient remedy in *gout of the spleen*, as well as in *pachymeningitis*

The SOLUTION OF NITRATE OF SILVER is a reliable caustic in the treatment of *pharyngeal ulcerations of the os uteri*.

The use of mercurials is usually in promoting resolution of fibrous inflammation.

Internally.—The principal use is as an antisyphilitic. Mercury is an antisyphilitic, being particularly efficient in the methods of mercurializing a patient which will be made under "Administration." It is necessary to caution the therapist to make a positive diagnosis of syphilis before treatment, as otherwise the consequences are serious.

Mercury has been used in all forms, possibly from ignorance of its proper use, with less favorable results in the form of pills, while a careful study of syphilis in tertiary syphilis it is inferior to iodine, however, do better under mercury.

The medical uses of mercurial in the alimentary tract are very numerous.

Chronic dysentery will frequently be benefited by small doses of CORROSIVE MERCURY (0.0005-0.001 Gm) of *diarrheas* of children—particularly of the offensive stools—together with *hemorrhoids* benefited by small doses of CALOMEL.

As a purgative in *bilious attacks*, *hepatic congestion*, and *cirrhosis* CALOMEL is an extremely valuable drug. Its action as a purgative will be more fully described under "Cathartics." Calomel is also a remarkably efficient diuretic, especially when combined with digitalis.

Many acute febrile and inflammatory conditions, such as *meningitis*, *pericarditis*, and *hepatitis*, are sometimes benefited by the internal administration of calomel, though in acute inflammations the chief value of the drug, whether specific or non-specific, is manifest in *iritis* and in *acute bronchitis* which shows a tendency to persist.

Calomel given early in from 10- to 20-grain (0.6-1.3 Gm.) doses in cases of *pneumonia* is esteemed very highly by some authorities.

Calomel and opium have been used and recommended by some physicians in the treatment of *Asiatic cholera*. In *cholera* and *marasmus of infants* very small doses of corrosive mercuric chloride, $\frac{1}{16}$ to $\frac{1}{100}$ grain (0.0005-0.0006 Gm.) have proved very beneficial in many cases.

Contraindications—Mercury is usually contraindicated in *tuberculosis* and in persons of *strumous diathesis*, and while it is of value when judiciously employed in *chronic interstitial nephritis*, it must nevertheless be given cautiously, and if the excretion of urine is diminished by its use, the drug should be immediately discontinued.

Children, though not easily salivated, are very susceptible to other poisonous actions of calomel.

Ordinarily, *acute asthma*, *diarrhea* and *dysentery* in adults would contraindicate the use of mercurials.

Administration—Mercury is introduced into the system by—

1. *Inunction*—The portion of the body upon which the preparation is to be applied should first be thoroughly washed with soap and warm water, and the ointment well rubbed in with the palm of the hand. The best localities for application are the inner sides of the thighs, the sides of the chest, the axilla, abdomen, and back. An excellent way to mercurialize a child is to put the ointment on the abdomen beneath a flannel binder. An efficient means also of favoring absorption is to apply the ointment to the soles of the feet, when it will be rubbed in by walking. Mercurial ointment is ordinarily used for this purpose, 15 to 30 grains (1.0-2.0 Gm.) being required for each inunction. Oleate of mercury when applied externally should not be rubbed in, the simple application to the skin being sufficient.

2. *Fumigation*—The iodide, mercuric sulphide, and calomel are used in this manner. The latter preparation being preferable, is the one ordinarily used. From 5 to 20 grains (0.3-1.3 Gm.) of calomel are put in a plate or a porcelain dish over a lighted spirit lamp. These are placed under a cane-bottomed chair, in which the patient sits nude, enveloped in a blanket reaching to the floor and fastened loosely about the neck. The calomel is volatilized by the heat, deposited in minute particles over the surface of the body, and

readily absorbed. The fumigation continues for ten to fifteen minutes.

3. *Endermically*.—Mercurials may be used in the form of ointment and certain other preparations.

4. *By the Rectum*.—Mercury may be used in the form of a suppository containing 5 to 10 grains of mercurial ointment.

5. *Hypodermically*.—From $\frac{1}{2}$ to 1 cc. of the bichloride of mercury, dissolved in 10 cc. of distilled water, is injected into the gluteal region or in the subcutaneous tissue. The solution of peptonate of mercury is also used, though the preparation which is used is a solution of the formamidate of mercury. The dose is 1 cc. corresponding to $\frac{1}{4}$ grain (0.1 Gm.) of mercury.

Numerous preparations have been used. Many of them are of service in the treatment of their individual consideration. Cyprine is also used.

6. *Internally*.—In the treatment of syphilis the use of mercury has been employed in many forms. Bumstead prefers the bichloride of mercury and the mercurial pill; Berkeley and Fox, the cyanide; Hutchinson, the mercuric iodide. The little which of these preparations is used in the treatment of syphilis is with the patient is advisable. Calomel and corrosive sublimate are ordinarily used in the treatment of the venereal tract. As a rule, the first

IODINE AND ITS PREPARATIONS

Iodum—Iōdi—Iodine

Origin.—It is found in the ashes of sea-weeds and is obtained in the purification of Chile sal.

Description and Properties.—Heavy, black, crystalline plates, having a metallic luster, a distinctive odor, and imparts a deep-brown, slowly evanescent stain to vegetable colors. Iodine is soluble in about 2 parts of alcohol, with a brown color; also freely soluble in ether, with a brown color, and in chloroform, with a brown color. It should be kept in glass stoppered bottles, in a cool place.

Dose.—About $\frac{1}{4}$ gram (0.016 Gm.) [rarely given in substance].

Official Preparations

Liquor Iōdi Compōsitus—Liquōris Iōdis (Liquor of Iodine) (Liquor of Iodine).—Iodine, 5 g.; potassium iodide, 15 g.; make 100 parts. Strength, 5 per cent.

Dose.—1-10 minims (0.06-0.6 cc.) [3 to 10 drops].

Tinctūra Iōdi—Tinctura Iōdis (Tincture of Iodine).—Iodine, 1000; alcohol, 1000. Strength, 7 per cent.

Dose.—1-5 minims (0.06-0.03 cc.) [1-5 drops].

Unguētum Iōdi—Unguēntū Iōdis (Iodine Ointment).—Iodine, 4; glycerin, 12; benzoinated lard, 100. Use.

Acidum Hydrîodicum Dilûtum—Äcidi Hydrîodici Diluti—Diluted Hydriodic Acid. U. S. P.

Definition—A solution of hydriodic acid, HI, containing not less than 20 per cent by weight of the anhydrous acid, and about 90 per cent of water.

Description and Properties—A clear, colorless liquid, odorless, and having an acid taste. It should not become colored on keeping. Miscible in all proportions with water or alcohol. In the present preparation there is a small quantity of phosphoric acid. This acts as a preservative by retarding any possible action to hydriodic acid. The method of preparing it for which see the Pharmacopœia official recommended in the 1895 U. S. Pharmacopœia in connection with the preparation of Syrupus Äcidi Hydrîodici, the latter which prepared from the Äcium Hydrîodicum Iodatum. The method is simple and requires no special apparatus or chemicals (Hewy).

Dose—Average dose 8 minims (0.5 Cc.) U. S. P.

Caution—Should be kept in small, tincoated, glass stoppered bottles, protected from the light.

Syrupus Äcidi Hydrîodidi—Syrupi Äcidi Hydrîodidi—Syrup of Hydriodic Acid. U. S. P.

A very viscid containing about 1 per cent by weight of absolute hydriodic acid.

Description and Properties—A transparent, colorless or only faintly straw colored liquid, odorless, and having a sweet and acidulous taste.

Dose—15-2 fluidrams (20-30 Cc.) (1 dram 4 Cc.) U. S. P.

Ammönii Iöddidum—Ammönii Iöddidi—Ammonium Iodide. U. S. P.

Origin—It is prepared by dissolving potassium iodide and ammonium carbonate in boiling water, adding alcohol, filtering, washing the filtrate, and evaporating it to dryness.

Description and Properties—Minute, colorless, cubical crystals, or a white, granular powder, without odor when cold, but emitting a perceptible white, steamy, and having a sharp, saline taste. The crystals are soluble in water, alcohol, and ether, and are insoluble in the oil and glycerine. In the dry state it is not the colorless of iodine. Soluble in 25 parts of water and in 9 parts of alcohol. Ammonium iodide should be kept in small, tincoated glass stoppered bottles.

Dose—1-20 grains (0.15-1.2 Gm.) (6 grains 0.35 Gm.) U. S. P.

Potässii Iöddidum—Potässii Iöddidi—Potassium Iodide. U. S. P.

Origin—Iodine is dissolved in a solution of caustic soda in hot distilled water. The solution is evaporated and the residue heated with charcoal. Iodine containing water, when heated, and evaporated.

Description and Properties—Colorless, transparent, transparent, cubical crystals, or a white, granular powder, having a pearly luster, metallic color, and a pungent, saline and glassy and bitter taste. Insoluble in dry air and but slightly decomposed by moist air. Soluble in 100 parts of water and in 22 parts of alcohol, and soluble in 25 parts of glycerine. Potassium iodide should be kept in well stoppered bottles.

Dose—2-30 grains (0.12-2.0 Gm.) (7½ grains 0.5 Gm.) U. S. P.

Official Preparations

Unguentum Potässii Iöddidi—Unguenti Potässii Iöddidi—Ointment of Potassium Iodide—Dissolve 10 potassium iodide, U. S. P., in 100 parts of ointment base. For ester of use.

Sōdii Iōdidum—Sōdii Iōd**U. S. F.****Origin.**—Prepared from a solution of soda of potassium iodide.**Description and Properties.**—Colorless, crystalline powder, odorless, and having a saline taste; deliquesces and becomes partially decomposed, assuming thereby a reddish color. Soluble in water and in alcohol. It should be kept in well-stoppered glass bottles.**Dose.**—2-30 grains (0.12-2.0 Gm.) [7½ grs.]**Strōntii Iōdidum—Strōntii Iōd****U. S. F.****Origin.**—Prepared by neutralizing freshly precipitated strontium carbonate with hydrochloric acid, concentrating the filtrate, and crystallizing.**Description and Properties.**—Colorless, crystalline powder, odorless, and having a bitterish, saline taste; exposure to air and light. Soluble in water, and slightly in ether. It should be kept in dark glass bottles.**Dose.**—2-30 grains (0.12-2.0 Gm.) [7½ grs.]**Zīnci Iōdidum—Zīnci Iōdidi****Origin.**—Obtained by dissolving zinc in hydrochloric acid, digesting granulated zinc in 10 parts of iodine to dryness.**Description and Properties.**—A white, crystalline powder, having a sharp, saline, and metallic taste. It is oxidized by oxygen from the air and to become brown from water, alcohol, or ether. Zinc iodide should be kept in glass bottles.**Dose.**—1-3 grains (0.06-0.18 Gm.) [1 gr.]**Sūlpuris Iōdidum—Sūlp****Iodide. U. S. F.****Origin.**—Prepared by heating washed sulphur and iodine until they combine.**Description and Properties.**—Brown, granular, having a grayish-black, metallic luster, having the odor of iodine. Almost insoluble in water; soluble in about 100 parts of carbon disulphide. Alcohol and ether dissolve it. Sulphur iodide should be kept in glass-stoppered glass bottles.**Dose.**—1-5 grains (0.06-0.3 Gm.).**Plūmbi Iōdidum—Plūmb****U. S. F.***See Lead.*

Other compounds of iodine, used internally, recently brought to the practitioner's attention are: *iodine trichloride*, *iodine trichloride*, *iodine trichloride*, recommended as alterative; *iodo-allylamine*; *iodo-phenacetine*, used in rheumatism in 8 grain dose; *iodo-thione* (iodine and theine), a heart stimulant; and *iodothyron* (see under *Thyroid Extract*).

Antagonists and Incompatible
The alkaloids and most of the min

ammonia. The iodides are incompatible with mineral acids and acid salts, bismuth subnitrate, alkaloids, silver nitrate, soluble lead salts, spirit of nitrous ether, potassium chlorate, licorice, and preparations containing starch. The tincture of iodine is incompatible with water and aqueous preparations.

Synergists.—Water, alkalies, and remedies increasing tissue waste.

Physiological Action.—*Externally and Locally*.—Iodine is a powerful disinfectant and rubefacient, as well as vesicant, caustic, parasiticide, and antiseptic. When applied to the skin or mucous membrane it produces a yellow, brown, or black stain, and is irritant or caustic, according to the strength and frequency of the application. The discoloration, however, can be easily removed by sodium hyposulphate or ammonia.

It combines with the albumin of the tissues and prevents putrefactive changes. When tincture of iodine is frequently applied or large amounts are used, desquamation of the skin is produced, and sometimes rapid vesication, or perhaps sloughing. The blood-vessels of the organs subjacent to the area to which it is applied are reflexly dilated, rendering this drug an efficient counterirritant.

The vapor of iodine when inhaled produces considerable irritation of the respiratory passages, exciting cough, sneezing, increased secretion of mucus, dyspnea, and more or less pain in the chest, although when inhaled in moderate amounts its antiseptic properties exert a beneficial influence upon the bronchial tissues, preventing decomposition of the secretions.

The iodides have little local action.

Internally.—*Digestive System*.—Taken internally in small doses, iodine acts as a gastric tonic, minute doses acting as a sedative, allaying nausea. In other cases a single moderate dose may occasion gastric uneasiness, larger amounts intensifying the discomfort and causing violent vomiting, increased salivary flow, abdominal pains, and purging.

The iodides in moderate doses produce a sense of warmth in the stomach, larger amounts acting like iodine, though less irritating to the gastro-intestinal tract than the latter drug.

Owing to their rapid diffusibility, the iodides can be tasted in a few minutes after their ingestion, considerably increasing the flow of saliva.

Circulatory System.—The effects of iodine and its salts have been variously reported, it being claimed that their tendency is to contract the vessels and cause increased cardiac action. Introduced into the veins, a slight increase, followed by decrease of pressure, has been observed. The rapidity of elimination from the blood is doubtless an impediment to any marked action on the circulation. Fraxton claims that potassium iodide dilates the blood-vessels, thereby increasing glandular secretion.

The iodides are all supposed to be converted into the sodium iodide in the blood, without modifying the composition of that fluid.

They probably form a loose combi-

Nervous System.—No special action of potassium iodide is known to occasion distress of mind and depression now and then by lassitude and muse rather to the influence of potassium.

Respiratory System.—Little or no action has been noted.

Absorption and Elimination.—Iodine is absorbed by the mucous membranes of the blood, mainly in combination with protein.

Elimination takes place by various routes. In the milk, intestinal and nasal mucous membranes appears to be even more active than in the blood. The drug escapes largely through the kidneys in the form of water, urea, uric acid, phosphoric acid, etc. At the points of elimination the iodine is in a nascent state, thus occasioning more or less of the symptoms of iodism.

It should be borne in mind that iodine is a normal constituent of the thyroid gland and that the action of iodine in the body is conditioned by the activity of the thyroid and parathyroid glands. The action of iodides on metabolism has some special interest.

Temperature.—Slight rises in temperature may occur after prolonged dosage, possibly a result of reflex action on the skin, or an infection.

Eyes.—Beyond a local congestion and a sclerotic coat under certain conditions, no special action is observed. The symptoms of ocular iodism are described under "Poisoning."

Uterus.—Small doses may increase the flow and act as aphrodisiacs; larger doses produce a disiac effect; while prolonged administration may act on the ovaries. It has been maintained that catamenia are liable to increase, and that iodine may cause abortion.

Untoward Action.—The untoward actions of iodine in patients, are identical with those of iodine.

Poisoning.—Taken in excessive doses, iodine has even produced death, though the symptoms of acute poisoning are those of severe irritation by distressing stomachic and abdominal pain, and painful irritation of the esophagus, leading to vomiting.

An early symptom is a strong irritation of the throat together with increased salivation. Swelling of the throat and dysenteric pain have been reported.

from external application. Very immoderate doses are attended with rapid and feeble pulse, deathly pallor, severe renal irritation affecting urinary secretion, and final loss of vital power followed by respiratory failure.

The condition induced by prolonged or excessive use of iodine or its salts is known as *Iodism*. Together with a metallic taste there are present tenderness of the teeth and gums, nausea, and symptoms of gastric irritation.

Marked symptoms involving practically the entire respiratory mucous membrane, coryza, coughing, occasionally dyspnea, etc., this catarrh may extend to the conjunctivæ. The skin is always involved—acneiform eruptions—even a vesicular and purpuric variety not unfrequently occurs.

Moreover, muscular twitchings, edema of the glottis, neuralgic pains, and atrophy of mammae, testicles, and other tissues occasionally supervene. Anæmia and even cachexia are often manifest.

Treatment of Poisoning—The use of large amounts of starch, in the form of arrowroot or starch-water, has been successfully adopted as an antidote. Hypodermic injections of ammonia, strychnine, digitalis, alcohol, and atropine have been employed with excellent results, as tending to restore the circulation and assist respiratory movements. More recently bicarbonate of sodium has proved an efficient antidote.

The use of the gastric siphon and the application of heat to the body and extremities are naturally of the first importance.

Therapeutics—Externally and Locally—The TINCTURE, COMPOUND SOLUTION, and OINTMENT are extensively employed as counterirritants and as aids to the absorption of fluid. The tincture is an efficient application to joints in *chronic rheumatism*, *gout*, and *synovitis*, and in *eczema*, both for the purpose of aborting an attack and to aid the absorption of fluid when effusion has taken place. In *neuritis*, *osteitis*, *periostitis*, *neuritis*, *neuritis*, *neuritis*, etc., the tincture, applied externally, will often be of service. Combined with tincture of aconite, equal parts, a useful application to sore gums is secured. The TINCTURE OF IODINE has been recommended as an efficient application in recession of the gums attendant upon *pyorrhea alveolaris*.

This same preparation is of marked benefit when hypodermically injected in *gout*, particularly of the soft or cystic variety, *hydrocele*, *empyema*, *extensive serous arthritic effusion* unaccompanied by inflammation, *spinal meningitis* and *anal hæmorrhoids*.

The tincture is also a very efficient application in *chronic metritis* and *chronic endometritis*.

In many diseases of the skin iodine serves a useful purpose as a discutient and parasiticide, *scabies*, *lupus*, *chancres*, *lichen scrofularum*, etc., especially indicating its use.

The vapor of iodine is frequently employed in subacute *catarrhal deafness* and in *acute coryza*.

A mixture of tincture of iodine $\frac{1}{2}$ fluidrachm (20 Cc.), carbolic

acid 10 minims (0.6 Cc.), glycerin (45.0 Cc.), has been highly recommended for the treatment of *chronic pharyngitis*.

As an inhalant in *chronic laryngitis* iodine in the form of an emulsion is highly esteemed by many physicians.

Many iodine substituted derivatives have been used (see *Antiseptics*, *Iodoform*, etc.).

Internally.—One of the principal indications for iodine and the iodides is in the treatment of *scurvy*. All the manifestations of this disease, *periorbital edema*, *pericystitis*, *meningitis*, *endarteritis*, *gout*, are relieved by large doses of the iodides.

Iodine is peculiarly useful in combating the effects of mercury from the system of patients with *cachexia*, *paralysis*, etc. Other metal poisons are eliminated by a course of potassium iodide.

POTASSIUM IODIDE is of marked value in the treatment of manifestations of *scrofula*, such as *enlargement of cartilaginous structures* and *mucous degeneration of adenitis* and *enlargement of the thyroid gland*.

With regard to the use of iodide in the treatment of *aneurysm of the aorta* Walshe says: "Not only the local but also the general distress followed by the pressure-symptoms have been mitigated by the use of potassium iodide. The aneurysm has taken place within the sac, while the tension of the sac has exhibited sensibility to the iodide. The cushion-dulness has exhibited sensibility to the iodide. The results have been reported favorably of its use."

As cardiac tonics the iodides are especially serviceable in *fatty degeneration of the heart*. They mitigate the symptoms of *chronic heart failure*, especially those of the aortic orifice. They are a valuable remedy in *chronic asthma* and *bronchitis*, especially in the case of inflammatory products of *pneumonia*.

The *spasmodic asthma* of adults is relieved by potassium iodide, both of which alternate with *eczema* and *asthma* by potassium iodide.

Even *hereditary asthma* occurs at a milder form when the patient is kept under the influence of moderate doses of this drug.

In the early stages of *cirrhosis*, with *ascites*, potassium iodide is a useful remedy. *Induration* is relieved by iodine, with *muscular rheumatism* it is one of the best remedies. It has been advocated as a successful remedy in *gout*.

AMMONIUM IODIDE is highly recommended in acute *catarrhal pneumonia* and *jaundice*, especially useful in *catarrhal jaundice*. It is suggested as a good remedy in *hay fever*.

The SYRUP OF HYDRIODIC ACID has been commended by Craig as a valuable agent in *acute rheumatism*. Small doses of the *nature of iodine* have been found efficient in the *vomiting of pregnancy*.

Contraindications—The drug should be discontinued at once when symptoms of iodism appear. It is contraindicated also in pulmonary tuberculosis when there is a rapid change taking place in the lung. The iodides should not be given immediately before or after the administration of quinine.

Administration.—The sodium iodide is less active and toxic than the potassium salt. The strontium iodide may be used for the same purpose as the other iodides, and possesses the advantage of disturbing the stomach less, besides being less likely to produce iodism.

The iodides should be given in a large quantity of liquid. Their unpleasant taste may be concealed to a considerable extent by dissolving them in carbolic acid water or Vichy water. Milk, compound syrup of sarsaparilla, and current and raspberry syrups have all been used for this purpose.

It is said that tincture of belladonna or sodium bicarbonate prevents the coryza caused by the iodides.

The syrup of hydriodic acid is more pleasant to the taste, and has but little tendency to produce iodism or untoward effects. This preparation should always be administered upon an empty stomach. The syrup of the iodide of wine is a useful combination in the cachexia of syphilis.

Colchicum—Colchici—Colchicum. U. S. P.

(MEADOW SAFFRON.)

Origin—The dried corn and seed of *Colchicum autumnale*, known respectively as COLCHICI CORNU and COLCHICI SEMEN. A plant indigenous in Europe in the southern and central portions of which it is frequently found as pasture and meadow, flowering in September or October, and ripening its seeds in June following. The corn and seeds are official.

Description and Properties—The corn is about 1 inch (25 Mm.) long, oval, flattened, with a groove on one side; externally brownish and on almost entirely white and wood often in transverse slices, breaking in halves and breaking with a dense, mealy fracture, inodorous, taste somewhat bitter, and somewhat acid. It should contain not less than 0.31 per cent of colchicine.

Dose—2-8 grains (0.12-0.5 Gm.) in powder (4 grains (0.250 Gm.) U. S. P.). Colchicum seeds are subglobular, about $\frac{1}{16}$ inch (2 Mm.) thick, very slightly flattened at the hilum, reddish-brown, brown pitted externally, whitish, very hard and tough, inodorous, taste bitter and somewhat acid. They should contain not less than 0.15 per cent of colchicine.

Alkaloids—1-5 grains (0.05-0.3 Gm.) (1 grain (0.1 Gm.) U. S. P.). Both the corn and seed contain two alkaloids, colchicine and colchicine. These are closely related chemically. Colchicine is said (Kochka) to be non-poisonous.

Official Preparation.

Colchicina—Colchicine—Colchicum, U. S. P.—**Preparation**—An official, (U. S. P. 1900) prepared from colchicum. A drug classed with the alkaloids, containing less than 0.1 per cent.

Character.—Pale yellow leaflets or a pale
on exposure to light, having an odor suggesting

Solubility.—Soluble in water (1 : 22) and

Incompatibility.—Colchicine is precipitated

Dose.—Average dose: $\frac{1}{11}$ grain (0.0005)

Official Preparations

Extractum Colchici Cormi—**Extracti-
cum Cormi.**—*Dose,* $\frac{1}{2}$ –2 grains (0.03–0.12 G)

Official Preparations

Fluidextractum Colchici Seminis—**Fl-
extract of Colchicum Seed.**—*Dose,* 1–5 min

Tinctura Colchici Seminis—**Tincture
chicum Seed.**—*Dose,* 10–30 minims (0.6–2.0

Vinum Colchici Seminis—**Vini Col-
Seed.**—*Dose,* 10–30 minims (0.6–2.0 (c), U

Antagonists and Incompatible
nize the cardiac depression produc
and vegetable infusions containing
chine.

Synergists.—Diuretics, purgati
and alkalis promote the therapeuti

Physiological Action.—*Extern.*
a decided local irritant, and when
rubefacient. The dust when inhale

Internally.—**Digestive System.**—
cum slightly stimulates the salivar
secretions. If these doses are rep
tion of heat is experienced in the e
of appetite and frequently by naus
produce purging and colic. Large
and choleric form or bloody evacua
abdominal pain and tenderness, exc
symptoms produced by a violent g

Circulatory System.—Full medi
great depression of the circulation,
pulse. The marked cardiac depre
when poisonous doses of colchicum
result of the severe gastro-enteritis
the heart.

Nervous System.—The nervous
nal doses. Even when poisonou
intellect usually remains unimpaired
the drug induce marked cerebral
ments have been made regarding th
nervous system. The drug eviden
ferently. Thus, numbness or prick
and occasionally convulsions, have
investigations of Houdé-Laborde

show that it has no influence upon the centers of intelligence and volition, and does not induce paralysis of central origin, either motor or sensory, though the sensory nerves are considerably depressed.

Respiratory System.—Large or poisonous doses of colchicum render the respiratory movements slow and shallow. This action is not due to any direct effect upon the respiratory center—although Rossbach and Wehmer maintain the contrary—but reflexly to the depression occasioned by the violent action of the drug upon the gastro-intestinal tract.

Absorption and Elimination.—Colchicum is quite rapidly absorbed, and is eliminated chiefly by the bowels and kidneys, the skin sharing to some extent in the excretory process. Some observers allege that colchicum does not increase the amount of urine or the excretion of urea and uric acid, while others claim that these substances are increased.

Temperature.—Under moderate medicinal doses the temperature is unaffected, though doses large enough to produce emeto-cathartics are followed by a reduction of temperature.

Untoward Action.—Many symptoms described under *Poisoning*, have been produced by very small doses. It is a matter of speculation whether these untoward manifestations were due to a decided idiosyncrasy on the part of the patient, or to the fact that the preparation employed might have contained an unusually large percentage of the alkaloid. Recent studies point to the fact that colchicine may be oxidized in the body to oxydicolchicine, which is the active poison.

Poisoning.—The symptoms of poisoning by colchicum are violent vomiting and purging, griping and intense pain in the abdomen, precordial distress, and at times excessive salivation, sweating, or possibly convulsions. The initial symptoms may be delayed two or three hours or even more. A great sense of depression is characteristic. This is followed by weakness of the muscles, those of the extremities seem to be partly paralyzed. While death is for a time delayed under a poisonous dose, a fatal termination is usual (95 per cent.). The patient suffers excruciatingly, being little relieved by treatment, and lies of respiratory paralysis in twenty-four to forty-eight hours. The minimum lethal dose of colchicine is 40 to 60 milligrams, up to 1 grain.

Treatment of Poisoning.—All that can be done is to combat symptoms, giving opium for pain, oil and demulcent drinks for the irritation, and stimulants to counteract respiratory and cardiac depression. Washing out the stomach or the use of emetics may be required. Tannic acid serves as a partial antidote, precipitating the colchicine.

Therapeutics.—*Externally and Locally*.—Colchicum has no local therapeutic action.

Internally.—Colchicum is valuable for *gout* in all its varied manifestations. *Rheumatism, dysentery, dyspepsia, bronchitis, asthma, neu-*

ralgia, and *eczema* dependent upon a benefited by colchicum.

This medicine, while occasionally *tism*, and occasionally of some benefit no value in acute articular rheumatism.

Its value is more apparent in acute the first attacks than in succeeding chronic rheumatism, yields better to and potassium iodide than to colchicum.

In combination with certain other excellent purpose as a cholagogue, is effective in relieving *ascites* due to oil. Salicylic acid or the salicylates are effective in these conditions.

Colchicum is sometimes employed *cerebral* and *portal congestion*, although for this purpose it occasions cerebral distress. It is unsafe in this condition.

In combination with certain other excellent purpose as a cholagogue, is effective in relieving *ascites* due to oil.

Hypochondriasis resulting from rheumatism benefited by colchicum.

Contraindications.—The drug in acute inflammatory conditions of the bowels should be cautiously administered.

Administration.—The liquid preparation and, in order to secure the full effect, unnecessary to give it in doses sufficient. The initial dose, therefore, should be small to avoid gastric disturbance.

The beneficial effects of colchicum are due to emptying the intestinal canal by means of its cathartic action.

The preparations of colchicum vary. The crude drug contains different percentages according to the season of the year in which it is collected. To this variation the alkaloid is to be added to its activity, it should be given in variable doses.

Sarsaparilla—Sarsaparillæ

Origin.—The dried root of *Smilax medeorum* Hooker, *Smilax papyracea* Dubamel, *Hondurna* Sarsaparilla, which is probably identical.

The species of *smilax* grow in swampy forests of the northern portion of Brazil. They are woody climbing plants.

Description and Properties.—The root is very long, cylindrical, longitudinally wrinkled, internally showing a whitish and mealy or spongy tissue, a circular wood zone enclosing a broad pith, bitterish, and acid. The thick, woody, knotted root contains an active principle, sarsapillin.

with water and otherwise closely resembles saponin in its action. It also contains *saponin* and *arsasaponin*, two glycosides, the latter of which is the most poisonous glycoside in the plant.

Dose—30-60 grains (2.0-4.0 Gm.) [30 grains (2 Gm.), U. S. P.]

Official Preparations.

Fluidextractum Sarsaparillæ—**Fluidextracti Sarsaparillæ**—**Fluidextract of Sarsaparilla**—*Dose*, ʒj-2 fluidrams (2.0-8.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Fluidextractum Sarsaparillæ Compositum—**Fluidextracti Sarsaparillæ Compositi**—**Compound Fluidextract of Sarsaparilla**—*Dose*, ʒj-2 fluidrams (2.0-8.0 Cc.) 30 minims (2 Cc.), U. S. P.]

Syrupus Sarsaparillæ Compositus—**Syrupi Sarsaparillæ Compositi**—**Compound Syrup of Sarsaparilla**—A fluidextract, 20 per cent. with the fluidextracts of glycyrrhiza and scilla, and the oils of saxifraga, anise, and gaultheria.

Dose, 2-4 fluidrams (8.0-16.0 Cc.) [4 fluidrams (16 Cc.), U. S. P.]

Antagonists and Incompatibles.—Alkalies and free iodine are incompatible with the official preparations of sarsaparilla.

Synergists.—The alteratives, diaphoretics, and diuretics.

Physiological Action.—Sarsaparilla has no local influence. Internally its action is due to the saponins contained. These have been discussed elsewhere.

Therapeutics.—As with guaiac, the history of sarsaparilla is full of interest. Introduced into Europe in the sixteenth century by the Spaniards, who had learned of its alleged virtues in constitutional *syphilis* in Peru, San Domingo, and Brazil, it retained its reputation as a specific in this disease for a century or more, when it was abandoned, only to be revived at the close of the eighteenth century. Since that time it has retained its place in medicine more through the wonderful virtues ascribed to it by nostrum-venders than to any real medicinal properties which it possesses.

The consensus of competent opinion seems to be that sarsaparilla can claim no special medicinal virtues other than its diuretic and diaphoretic properties.

Contraindications.—There are none.

Administration.—No special directions can be given for the administration of the various preparations. The compound syrup of sarsaparilla is quite pleasant to the taste, and is used extensively as a vehicle, particularly for potassium iodide. The sarsaparilla of the soda-water fountain is a mixture of aromatics, principally sassafras and wintergreen. It has no relation to sarsaparilla.

Stillingia—Stillingiæ Stillingia. U. S. P.

(Queen's Root.)

Origin.—The dried root of *Stillingia sibirica* L., a perennial herb growing in dry and sandy soil in the Northern United States as far north as Eastern Virginia.

Description and Properties.—About 1 foot (30 Cm.) long and nearly 2 inches (5 Cm.) thick, surface brown, slightly branched, compact, somewhat tough, granular on breaking with a spongy fracture, showing a white bark and porous wood, inner bark and medullary rays having numerous small brown tubercles. The odor is weak and unpleasant; the taste bitter, acrid, and pungent.

It contains an acid resin, volatile, a volatile and a fixed oil, starch, gum, tannin, and a picroside.

Dose—15-30 grains (1.0-2.0 Gm.).

Official Prepara-

Fluidextractum Stillingiae—**Fluidextractum Stillingie**.—*Dose*, $\frac{1}{4}$ –1 fluidram (1.0–4.0 Cc.) [30]

Physiological Action.—The action of sarsaparilla, the drug increasing the circulation of the heart and circulation.

Guaiacum—Guaiaci—

Origin.—The resin of the wood of *Guaiacum sanctum* L.

Description and Properties.—It is externally greenish brown, internally of a glassy reddish brown, transparent in thin splinters, fusing stronger upon heating; taste somewhat acrid, exposure to air. Soluble in potassium or sodium alcoholic solution being colored blue by the addition of a few drops of ammonia.

The principal constituents of guaiac resin are guaiacetic acid, and a small amount of gum. The resin is insoluble in water, but soluble in alcohol.

Dose.—5–30 grains (0.3–2.0 Gm.) [15 gr]

Official Prepara-

Tinctura Guaiaci—**Tinctura Guaiaci**.—*Minimum*, 2.0–4.0 Cc. [1 fluidram (4 Cc.), U. S.]

Tinctura Guaiaci Ammoniata—**Tinctura Guaiaci Ammoniata**.—*Dose*, 30–60 minims (1–2 fluidrams) [U. S. P.].

Antagonists and Incompatibles.—The mineral acids are incompatible with guaiacum. Guaiacum is chemically incompatible with the tincture of guaiacum.

Synergists.—Many of the diaphoretic and vegetable alteratives aid the action of guaiacum.

Physiological Action.—*Externally*, it is antiseptic, and possesses mildly astringent properties locally as a gargle.

Internally.—The action of guaiacum belongs to the volatile oil group, it is stimulant, circulatory, and respiratory system.

Therapeutics.—*Externally* and *internally*, it is an excellent application in *folliculitis*, and *quinsy*. For these cases it is used as an efficient gargle, or the troches of guaiacum.

Internally.—From the sixteenth century guaiacum was renowned as a cure for syphilis, introduced into Europe from San Domingo. At first, which the drug was employed rendered it more than beneficial, so that the guaiacum treatment was its most vigorous opponents being the introduction of mercury for the treatment of syphilis. The drug possesses properties which render it useful in *chronic rheumatism*, *neuralgic dysmenstruation*, and *gout*.

Guaiac is considered to be an efficient remedy in *lumbago* and *chronic gout*. Its most important service, however, in therapeutics is in the treatment of *quinsy*. It is doubtful whether there is any drug which will modify the course of this disease or abort an attack of tonsillitis so readily as this medicine. The tincture of guaiac is the preparation usually employed for this purpose, $\frac{1}{2}$ fluidrachm (2.0 Cc.) being given in the form of an emulsion every three or four hours.

Contraindications.—There are no marked contraindications to its use.

Administration.—The tinctures are very acrid and disagreeable to the taste, and should be given in the form of an emulsion. The emulsion of guaiac, a formula for which is given in the Dispensatories, is not unpleasant, and is altogether the best liquid preparation to give.

The lozenges of guaiac, allowed to dissolve slowly in the mouth, serve as an agreeable and efficient method of medicating the throat with this drug.

ACIDS—ALKALIS

ACIDS

MINERAL

THERE are certain characteristics which claim primary attention :

Concentrated mineral acids are caustic.

They combine with alkalis and unite with vegetable acids, settling out with bases. When in contact they combine with the protoplasm, the latter contracts and forming mucus with the albumin, forming acid album.

They diminish the functional activity of nervous systems. Applied locally in internally in poisonous doses, they paralyze muscles by coagulating the myosin.

The alkalinity of the blood is destroyed by the action of the acid, and the acidity is corrected by the internal administration of practically neutral salts.

They increase the secretion from the stomach and the secretion from acid glands.

Acidum Hydrochlōricum **Hydrochloric Acid**

(MURIATIC)

Origin.—A liquid composed of 31.9 parts of hydrochloric acid (HCL) and 68.1 parts of water.

Description and Properties.—A colorless liquid with an intensely acid taste. It mixes in all proportions with water and alcohol. It is contained in amber-colored, glass stoppered bottles.

Official Preparation

Acidum Hydrochlōricum Dilūtum—**Diluted Hydrochloric Acid** (DILUTED MURIATIC ACID). (U. S. P.)
Distilled water, 219.

Dose,—10-20 minims (0.6-1.2 Cc.) [15]

Acidum Nitrohydrochlōricum—**Nitrohydrochloric Acid**. (Described under Nitric Acid.)
Dose,—2-5 minims (0.12-0.3 Cc.), well diluted.

Acidum Nitrohydrochlōricum Dilūtum—**Diluted Nitrohydrochloric Acid**. (Described under Nitric Acid.)
Dose,—5-20 minims (0.3-1.2 Cc.) [15]

Acidum Phosphoricum--Acidi Phosphorici-- Phosphoric Acid. U. S. P.

Origin.—A liquid composed of not less than 85 per cent by weight of absolute orthophosphoric acid (H_3PO_4), 97.8 and not more than 1.5 per cent of water.

Description and Properties.—A colorless liquid, without odor, but having a strong acid taste. Specific gravity not below 1.707 at 25° C. (77° F.). Miscible in all proportions with water or alcohol. Phosphoric acid should be kept in glass-stoppered bottles.

Dose.—The diluted acid only is given internally.

Official Preparation.

Acidum Phosphoricum Dilutum—Acidi Phosphorici Diluti—Diluted Phosphoric Acid.—Diluted phosphoric acid contains 10 per cent by weight of absolute orthophosphoric acid.

Dose.—5-25 minims (0.3-1.5 Cc.) {25 minims (1 Cc.) U. S. P.}

Acidum Sulphuricum--Acidi Sulphurici--Sulphuric Acid. U. S. P.

Origin.—A liquid composed of not less than 97.5 per cent by weight of absolute sulphuric acid (H_2SO_4), 98 and not more than 1.5 per cent of water.

Description and Properties.—A colorless liquid of very characteristic odorless, and very caustic and corrosive. Specific gravity not below 1.84 at 25° C. (77° F.). Miscible in all proportions with water and alcohol with evolution of no such heat that the mixing requires great caution. Sulphuric acid should be kept in glass-stoppered bottles.

Official Preparations.

Acidum Sulphuricum Aromaticum—Acidi Sulphurici Aromatics—Aromatic Sulphuric Acid.—Essence of Sulphuric acid, 110; tincture of ginger, 50; oil of cinnamon, 1; alcohol, 10 parts.

Dose.—5-20 minims (0.3-1.2 Cc.) {15 minims (1 Cc.) U. S. P.}

Acidum Sulphuricum Dilutum—Acidi Sulphurici Diluti—Diluted Sulphuric Acid.—Diluted sulphuric acid contains 10 per cent by weight of absolute sulphuric acid.

Dose.—5-20 minims (0.3-1.2 Cc.) {30 minims (2 Cc.) U. S. P.}

Acidum Nitricum--Acidi Nitrici--Nitric Acid. U. S. P.

Origin.—A liquid composed of 68 per cent by weight of absolute nitric acid (HNO_3), 72.5 and 71.5 per cent of water.

Description and Properties.—A colorless, fuming liquid, very caustic and corrosive and having a powerful characteristic suffocating odor. Specific gravity about 1.405 at 25° C. (77° F.). Nitric acid should be kept in dark, amber-colored, glass-stoppered bottles.

Official Derivatives.

Acidum Nitricum Dilutum—Acidi Nitrici Diluti—Diluted Nitric Acid.—Diluted nitric acid contains 10 per cent by weight of absolute nitric acid.

Dose.—5-20 minims (0.3-1.2 Cc.) {30 minims (2 Cc.) U. S. P.}

Acidum Nitrohydrochloricum—Acidi Nitrohydrochlorici—Nitrohydrochloric Acid.—Essence of Nitric acid, 100; essence of Hydrochloric acid, 80 parts.

Dose.—From 5 to 10 minims. A golden, viscid, fuming, and very caustic liquid, having a strong odor of Hydrochloric acid, and a heat. It readily decomposes gold foil, and a drop of it on a piece of paper causes the formation of a white stain.

Dose.—1-3 minims (0.05-0.15 Cc.) {1-2 minims (0.2 Cc.) U. S. P.}

Acidum Nitrohydrochloricum Dilutum—Acidi Nitrohydrochlorici Diluti—Diluted Nitrohydrochloric Acid.—Essence of Nitric acid, 100; essence of Hydrochloric acid, 100; distilled water, 750 parts.

Dose.—5-20 minims (0.3-1.2 Cc.) {15 minims (1 Cc.) U. S. P.}

Antagonists and Incompatibles.—Preparations are incompatible (forming precipitates) with oxidizable substances—phosphorus, stannous chloride, etc. Insoluble in alcohols, ethers, carbohydrates, etc. All compatible with the alkalies and their carbonates, silver, and decompose glycosides.

Synergists.—The action of hydrochloric acid on the digestive system is aided by the digestive ferments.

Physiological Action.—The general action upon the various systems is herewith given.

Externally and Locally.—Applied to the skin or to any tissue of the body, it destroys the tissues and destroys the protoplasm. Weaker solutions *causticize*, merely inflame. Stronger are applied, without destroying the tissue. Very weak solutions are irritant and *asthenic*.

Internally.—Digestive System.—If administered internally. Save with the effects of concentrated acids, therefore diluted acids only will be here considered.

The salivary glands are stimulated by the acid, moistening the mouth and improving digestion, and the duodenal glands are increased. The use of mineral acids impairs digestion by the action on the gastric glands, while protracted use leads to a train of symptoms—*anemia*, *lethargy*, *constipation*.

Circulatory System.—Diluted acids increase the blood-pressure and increase the force of the heart due to their stimulating action on the heart. Concentrated acids relax the muscles and blood-vessels. Mineral acids combine with the alkaline bases of the blood, lessening the viscosity.

Nervous System.—Medicinal doses of hydrochloric acid have **no special action upon the nervous system.**

Respiratory System.—No important action has been observed.

Absorption and Elimination.—Mineral acids, and hydrochloric acid, are readily absorbed. They combine into neutral salts in the intestines, and an excess of the acid which does not combine in the stomach and intestines is rapidly acting with its alkaline bases, and in the urine is eliminated by the kidneys, as acid salts.

Temperature.—Medicinal doses of hydrochloric acid have **no effect on the temperature.**

Untoward Action.—Mineral acids in large doses impair the appetite and cause toothache and gastric oppression, and

rhea. They may also produce anemia, paleness of skin, and loss of flesh (Nothnagel and Rossbach). When taken for long periods and in comparatively large quantities they have a distinct degenerative action on the heart, the liver, and the kidneys. The prolonged use of nitric acid may produce erosion of the gums and tongue, with loosening of the teeth. Chromic acid and osmic acid act very energetically on the parenchyma of the kidneys.

Poisoning.—The mineral acids when taken in a concentrated form and in toxic doses act as corrosive poisons, causing intense burning in the stomach and intestines and active gastric inflammation. Violent vomiting occurs, the ejected matter containing blood, and, in the case of hydrochloric acid, a white cloud of ammonium chloride is discerned if the ejecta be placed near the vapor of ammonia.

The respiration is greatly depressed, and there is a strong, persistent acid taste in the mouth, the mucous membrane of which is discolored, while the tongue is swollen and inflamed. There is great thirst, and the pulse becomes rapid and tense. The temperature, at first elevated, soon falls below normal, profound prostration supervening, and death resulting either from shock or from secondary inflammation.

A *postmortem* examination shows the results of corrosive poisoning: ulceration or evidences of intense inflammation of the mucous membrane of the mouth, esophagus, stomach, and intestines. Occasionally the walls of the latter are perforated. Should death be delayed for some time, fatty degeneration of the kidneys and other internal organs is found.

Treatment of Poisoning.—This should be prompt. The cautious administration of alkalis is indicated to neutralize the acid, though the evolution of carbonic-acid gas resulting from some may rupture the stomach. The stomach should be washed out, and this treatment followed by demulcent drinks and oil, milk, and eggs. Opium may be necessary for the relief of pain, and brandy or whiskey subcutaneously in case of collapse.

Therapeutics.—*Externally and Locally*.—HYDROCHLORIC ACID is employed as a caustic in *numa* and *putrid sore throat*. Mixed with two or three parts of honey, it is an efficient application to the throat in *dysphagia*. Andrews and Morris have recommended diluted hydrochloric acid for the removal of *leucoplasia*, and Chassagnac has utilized the acid in removing necrosed bone in *osteitis* and *caries*.

NITRIC ACID is a much more powerful caustic, and as such is used more extensively than any other mineral acid because of its limited action and the ease with which it is controlled. It is an excellent caustic in cases of *cancer of the cervix*, *anal warts*, *hospital gangrene*, *phlegmonous ulceration*, *tumors*, and *prolapse of the rectum*, especially in the case of children. In cases also of *lunged pneumonia* and *excessive hemorrhage from the uterus* it has been highly recommended. In certain diseases of the throat

nose, and ear this acid has been used as well as for its escharotic action in

Dermatologists find nitric acid to the removal and destruction of *epith* etc., caution being exercised in the an exfoliation of the skin, not suff result in a cicatrix.

Living recommends a very weak tincture of opium in *pruritis*.

PHOSPHORIC ACID, in the strength ounce (30.0 Cc.) of distilled water, h in the treatment of *scrofulous ulcers* tion into *tuberculous glands* of the n the same authority.

SULPHURIC ACID is perhaps the destructive caustic known. Its aff quent extensive action, render it, wh purposes. Mixed with powdered c paste which is an efficient caustic i etc. Frazer considers the strong a the *bites of rabid animals*. Diluted 6 parts of the strong acid to 4 pa recommended for *epistaxis*.

The eschar formed by the three nostic interest. Sulphuric acid, bro hydrochloric acid, white to grayish-v

Internally.—HYDROCHLORIC ACID the stomach, is indicated in certain ticularly in the atonic variety. In th decomposition and fermentation of relieved by the administration of p meals, or the same with bitters befor

In *intestinal indigestion* hydroch edy, given one to two hours after m

The diluted hydrochloric acid is a of *typhoid*. It allays thirst, moist and exerts an antiseptic influence in the flatus.

In certain *affections of the skin* c tion, hydrochloric acid often proves

NITRIC ACID has been used for th acid, although for digestive disorder

In *intermittent and periodical f* efficient remedy. In *hepatic disorde* acid deservedly holds a high plac same remedy is frequently employe but solely by reason of its improv

In the conditions known as o nitrohydrochloric acids serve an ex

The aphonia of singers and public speakers is often relieved by the diluted nitric acid, certain cases of *bronchitis* being also benefited by the same remedy.

Phosphoric acid has acquired some reputation as a remedy in *anemia* and as a tonic in *existing diseases* and *neurasthenia*. Its value, however, is based more upon hypothesis than upon the results of clinical observation.

Possibly phosphoric acid is superior to the other mineral acids only in its action in *diabetes*, in which disease it certainly possesses a remarkable influence in diminishing thirst and lessening the secretion of urine.

Sulphuric acid is inferior to nitric or nitrous acid in *severe diarrhea*. It is nevertheless an invaluable, as well as an old and tried, remedy in *cholera*.

This remedy also deserves favorable consideration in the treatment of *acute lead-poisoning*. Moreover, in *chronic lead-poisoning* water acidulated with sulphuric acid makes an efficient prophylactic, and the remedy has also been suggested as a preventive of *Asiatic cholera*.

Owing to its astringent and antiseptic properties this acid, particularly the aromatic sulphuric acid, proves a good remedy in certain cases of *diarrhea*. It is especially valuable in limiting the sweating in *phthisis*.

In *scurvy* and *purpura*, sulphuric acid has proved valuable, and it has been recommended as an internal remedy in *lichen*, *prurigo*, and many *itching diseases of the skin*.

Contraindications.—Acute inflammation of the stomach, rheumatism, gout, and where the urine is excessively acid and of high specific gravity.

Administration.—Only the diluted acids should be given internally, and even these should be further diluted, and taken if possible, through a glass tube, to prevent injury to the enamel of the teeth. They are best given after meals, and should not be administered for too long a period, and the first indication of untoward action, such as griping, diarrhea, etc., is to be taken as a warning that the drug must be withdrawn.

ORGANIC ACIDS.

Acidum Lacticum—Acidi Lactici—Lactic Acid.

U. S. P.

Origin.—An organic acid usually obtained by fermenting milk, or grape sugar to lactic fermentation. It is composed of 75 per cent by weight of a molecule water and $(CH_3)_3H_3O_2$, 25 per cent, and 25 per cent of water.

Description and Properties.—A colorless, strongly liquid, odorless, and a partly soluble acid and strongly corrosive to the respiratory system. Its specific gravity is about 1.200 at 60° F. It is miscible with water, alcohol, or other fluid.

Dose.—20 grains (1.3-1.5 Gm.) and 1 and over (60 grains) (3 Gm.). U. S. I.]

Official Preparation.

Syrupus Calcii Lactophosphatis.—**Syrupi Calcii Lactophosphatis**. Syrup of Calcium Lactophosphate. —Formula: Precipitated calcium carbonate, 25; lactic acid, 60; phosphoric acid, 36; orange-flower water, 55; sugar, 725; water, q. s. ad 1000. *Dose*, 1-2 fluidrams (3.7-7.3 Cc.) [2 fluidrams (8 Cc.), U. S. P.].

Antagonists and Incompatibles.—Alkalies and the salts of the mineral acids are incompatible with lactic acid.

Synergists.—Pepsin, vegetable acids, hydrochloric acid, and sodium chloride.

Physiological Action.—*Externally and Locally.*—Lactic acid is a caustic to highly organized tissues, resembling the mineral acids in its local action. It can dissolve false membrane.

Internally.—Digestive System.—It is thought to be present in the stomach during the first forty-five minutes of stomache digestion, but cannot be considered a normal constituent of the gastric juice.

Circulatory System.—Being absorbed from the stomach, it combines with bases in the blood, forming lactates which are rapidly converted into carbonates.

Nervous System.—Large doses are thought to depress the nervous system.

Absorption and Elimination.—It is absorbed from the stomach, undergoes a change in the blood, and is eliminated by the kidneys, although, according to Lehmann, when large doses have been taken it is found in the urine unchanged, and we have Benzelius and Scherer as authorities that lactic acid can be detected in the spleen and the muscular fluid. It has been found in the exudates in puerperal fever.

Untoward action, poisoning, and treatment of poisoning are similar to those of the mineral acids.

Therapeutics.—*Externally and Locally.*—It has been used locally for the same purposes as the mineral acids, but it is thought by many clinicians to be superior to the latter in *tuberculous ulceration*.

As a solvent of false membranes lactic acid is unquestionably superior to the mineral acids, being highly recommended for this purpose in diphtheria and croup by many authorities.

Internally.—Digestive System.—It is used in the digestive disorders, such as *atonic* and *irritative dyspepsia*, and in all those derangements of digestion which are benefited by hydrochloric acid. In *oxaluria*, *lithemia*, *chronic cystitis* with ammoniacal urine, *chronic dysentery*, and *dyspeptic* and *tuberculous diarrhea* it has proved an efficient remedy. It has been recommended as a prophylactic in *gout*.

Since this drug was suggested by Cantani as a remedy in *diabetes mellitus* it has been used with varying success. Balfour and Foster, as well as Cantani himself, have reported many cases which have greatly improved under the administration of lactic acid accompanied by an appropriate dietetic regimen.

Contraindications.—The same as for mineral acid.

Administration.—Lactic acid should be given well diluted.

Acidum Aceticum—Acidi Acetici—Acetic Acid.

U. S. P.

Origin.—A liquid composed of 36 per cent by weight of absolute acetic acid ($\text{C}_2\text{H}_4\text{O}_2$) and 64 per cent of water.

Description and Properties.—A clear, colorless liquid, having a strong, vinegary odor, a strong, sour taste, and a strongly acid reaction. Miscible with water in all proportions.

Dose.—The diluted acid only is given internally.

Official Preparations.

Acidum Aceticum Dilutum—Acidi Acetici Diluti—Diluted Acetic Acid. 16 per cent. *Dose*, 4–2 fluidrachms (3.7–7.4 c.c.) [Romanians, 2–5 c.c.] *U. S. P.*

Acidum Aceticum Glaciale—Acidi Acetici Glacialis—Glacial Acetic Acid.—100 per cent.

Acidum Citricum—Acidi Citrici—Citric Acid.

U. S. P.

Definition.—A tribasic organic acid, $\text{C}_6\text{H}_8\text{O}_7$ ($\text{C}_3\text{H}_5\text{O}_4$)₃, usually prepared from sugar.

Description and Properties.—A white, transparent, eight-sided prism, odorless, soluble in water, having a tart taste. Effervescent on addition of bicarbonates. Most water-soluble of vegetable acids. Soluble in 0.4 part of water and 1.5 parts of alcohol, in about 0.4 part of boiling water, and in 1.4 parts of boiling alcohol.

Dose.—5–20 grains (0.3–1.5 gram) [7½ grains (0.5 gram), *U. S. P.*]

Official Preparation

Syrupus Acidi Citrici—Syrupi Acidi Citrici—Syrup of Citric Acid.—*Dose*, 2–5 fluidrachms (1.7–4.2 fluid ounces) [1 per cent].

Acidum Tartaricum—Acidi Tartarici—Tartaric Acid. *U. S. P.*

Definition.—A dibasic organic acid, $\text{C}_4\text{H}_6\text{O}_6$ ($\text{C}_2\text{H}_3\text{O}_4$)₂, usually prepared from grapes.

Description and Properties.—A white, transparent, rhombic prism, or rhombic plates of a white powder, odorless, having a tart taste, effervescent on addition of bicarbonates. Soluble in 0.71 part of water, and in 1.07 parts of alcohol, and in about 0.5 part of boiling water, and in 0.2 part of boiling alcohol.

Dose.—50–200 grains (3.0–12.0 gram) [7½ grains (0.5 gram), *U. S. P.*]

Antagonists and Incompatibles.—Alkalies are chemically incompatible with the vegetable acids. With the alkaline, earthy, and metallic bases vegetable acids unite to form salts, the acetates of which are all soluble.

Synergists.—Alkalies and, under certain circumstances, mineral acids and the digestive ferments.

Physiological Action.—*Externally and Locally.*—The vegetable acids have about the same action externally and locally as the diluted mineral acids, not caustic, but irritant, acetic acid being the most powerful and citric acid the weakest.

Internally.—Digestive System.—The gastric glands is similar to that of the pancreas; the influence upon the stomach is not so marked as that of the acid, though the secretions from the glands are augmented by vegetable than by mineral acids. Continued doses of the vegetable acids produce epigastric pain, and may even occasion diarrhoea.

Circulatory System.—Large doses of the oxidizable organic acids increase the amount of uric acid in the urine, thus differing from the mineral acids.

Absorption and Elimination.—As the acids combine with the alkalies to form salts, as the potassium salts. They are eliminated chiefly by the kidneys, in solution of both water and solids. Elimination to a considerable extent by the intestinal canal.

Poisoning.—Their toxic effects vary with the acid. Citric is slightly toxic; tartaric is a severe poison, the symptoms of which differ from those of poisoning by the mineral acids. The most important symptoms are: Either gastro-intestinal collapse or, at times, there is simple stupor, unconsciousness, and death. Poisoning by potassium oxalate adds to the above, there is more profound cardiac collapse.

Treatment of Poisoning.—Mild alkalis are the best. In oxalic-acid poisoning by potassium oxalate, accidentally taken, or from barberry, rumex, or sorrel oxalis in any form, followed by magnesia or chalk, well diluted with water. Stimulants are necessary. Small doses of nuxvomine and atropine may be of service. In severe cases, a powerful corrosive acid.

Therapeutics.—Externally and Locally.—The acids here described are irritant, more or less so. Acetic acid being the most powerful. Dr. Williams regards acetic acid as superior to tartaric in obstetrical practice, employed in a 1 per cent. for this purpose. A dilute solution in gonorrhoea of the female. Glacial acetic acid is a powerful caustic, and are used in the treatment of growths, warts, corns, etc.

The most important use of acetic acid is in the treatment of certain parasitic skin diseases, probably the most common cases of ringworm and pityriasis. It is an efficient gargle in simple sore throat, and in the treatment of exanthemata, as well as in epistaxis.

CITRIC ACID is but little used locally, but has been employed with some success to

ing of "prickly heat" and *urticaria*. A sponge-bath of lemon and water is a grateful and efficient means of *reducing temperature* and checking *excessive sweating* in disease.

TARTARIC ACID has been used by Potter as an application to the throat in *diphtheria*, the effect being to convert the membrane into a gelatinous mass, which is more easily expelled.

Internally.—ACETIC ACID is little used internally. Citric acid, however, in the form of a lemonade, is a refreshing refrigerant drink in *fevers*, while a similar hot lemonade taken at bedtime is a valuable and agreeable means of aborting a "cold." Lemon- or lime-juice is useful in *scorbut*, being unquestionably the most efficient remedy for the disease.

It is well known by the laity that eating lemons increases the functional activity of the liver. Lemons and CITRIC ACID, therefore, are efficient remedies in relieving attacks of *biliousness* and *catharrhal jaundice*, and they even appear to counteract the effects of *malaria*. Lemon-juice is an old and esteemed remedy in *acute rheumatism*. Citric acid is an invaluable adjunct in rendering the urine bland in gonorrhoeal or other forms of *cystitis*.

Vegetable acids are used for the same disorders of the digestive tract as mineral acids, although not so efficient as the latter, especially hydrochloric acid. Much of the benefit derived from sour table-wines is due to the fruit-acids they contain.

Contraindications.—Ordinarily the same as for mineral acids. It is a matter of observation that nursing mothers may produce a troublesome diarrhoea in the infant by partaking too freely of vinegar or acid fruits.

Administration.—A solution of citric acid may be made of about the acidity of lemon-juice by dissolving 570 grains (10.93 Gm.) in 1 pint (473.17 Cc.) of distilled water. Vegetable acids when taken internally should be mixed with, or dissolved in, water and diluted and sweetened, that they may be pleasant to the taste and acceptable to the stomach.

SODIUM SALTS.

Sodium Chlorid—Södl Chlorid—Sodium Chloride.

U. S. P.

Description and Properties.—Colorless, transparent, cubical crystals, or a white, crystalline powder, soluble and having a purely saline taste. Permanent in dry air. Soluble in 2.8 parts of water at 25°C. (77°F.) and in 1.5 parts of boiling water. Insoluble in alcohol.

It should contain not less than 99 per cent. of pure sodium chloride.

Average Dose.—Grains, 240 grains (16 Gm.).

Sodium chloride, NaCl, although rarely given by way of the stomach, save as an emetic, plays such an important role in intravenous injections for the relief of shock, and is, moreover, so important a constituent of the body fluids, that it deserves consideration. The

physical phenomena connected with typical of a class of actions constituting physiological processes of the body and as work on Physiology.¹

Therapeutics.—Local Action.—The skin penetrates the superficial layers. Stronger solutions, by tending to draw out fluids—particularly to mucous membranes—be absorbed through mucous membranes to any great extent by the skin. On the other hand, weak (hypotonic solutions) irritate the epithelium, while strong solutions often inducing nausea and vomiting. Weak solutions are affected by small doses—indeed, they are to be helpful to good digestion.

Internally.—Salt in weak solution produces any marked physiological reaction. When injected intravenously in strong solution has been known to occur by reason of its action on the nerve cells. Death in these cases is accompanied by symptoms of lassitude, increased blood pressure, circulations. Circulation is not known to be affected. Blood changes are usually present, but agglutination of the red blood cells is not observed. With isotonic solutions no marked changes are observed.

Certain effects on the blood are observed. A salt solution is absorbed through the skin. Solutions bring about a condition of dehydration. A reverse condition may follow the use of solutions of salt 1-2 per cent. The reactions of lymph flow and blood flow are of vital importance as bearing on the data.

The action of isotonic salt solution is of particular moment, since this is the solution frequently introduced. In anemic conditions, with great rapidity, and the volume of blood, following its diminution from hemorrhage, blood-vessels become fuller; the action becomes stronger, and bleeding is more frequent. A comatose condition frequently may follow.

Saline solution thus introduces a marked action, particularly if the element of fluid in the flow of urine is due in large measure to the amount of fluid in the vessels, resting in the capillaries. The chlorides, and the uric acid, are eliminated in larger quantities.

¹ See Schaefer, *Text-Book of Medicine*.

phosphates, or urates, but practically all of these are increased in amount.

Tissue metabolism is stimulated by the use of salt, although certain investigators have thought that there results from its use a slight diminution in proteol catabolism. The general action is, however, one of increased lymphatic activity.

So far as salt baths are concerned, the effects, while they may be very beneficial, are not resident in the salt, so far as its absorption into the body is concerned. Hygienic, dietetic, and psychotherapeutic practices are more to the point in the treatment of patients at spas and watering places than the salts contained in the bathing water. As an irritant to the skin salt action is beneficial. It tones and invigorates the skin and thus, reflexly, the patient in general.

Salt when taken by the mouth is often very useful. It exerts a mild stimulating action on the gastric mucosa and in combination with sulphates and other acids and salts is an essential element in all of the mineral waters, which will be discussed later.

Taken by the rectum (enteroclysis) or by the skin (hypodermoclysis) isotonic salt solutions are invaluable in the treatment of colanise conditions due to hemorrhage, to cholera, to dysentery, and often to the toxemias of the infectious diseases, notably diphteria, typhoid, and pneumonia. Clinical evidence is certain as to the value of isotonic salt in solution for surgical shock, particularly when administered hot—112°-115° F. As a diuretic in kidney affections hot saline enemata are invaluable.

Liquor Sōdii Hydrōxidi - Liquōris Sōdii Hydrōxidi —Solution of Sodium Hydroxide. U. S. P.

SALT OF SODA HYDROXIDE

Origin. An aqueous solution containing about 5 per cent of sodium hydroxide, $\text{NaOH} = 276$.

Description and Properties. A clear, colorless liquid of dense, having a very strong and caustic odor and a strongly alkaline reaction.

Dose. 5-20 minims (0.1-1.5 cc.) 15 minims (1 cc.), U. S. P.

Sōdii Acētas - Sōdii Acetātis - Sodium Acetate. U. S. P.

Origin. It may be obtained by neutralizing acetic acid with sodium carbonate. The same strong, however, in medicinal uses as a large acid in the U. S. P. is the presence of the strong odor and a strongly alkaline reaction.

Description and Properties. A colorless, transparent, non-volatile, crystalline powder, odorless, and having a strong, caustic, alkaline reaction, strong, dryness. It is soluble in 11 parts of water and in 2 parts of alcohol. It is also soluble in 5 parts of boiling water and in 2 parts of boiling alcohol. It is a white powder, which is soluble in water.

Dose. 15-60 grains (1.0-4.0 gm.) [15 grains (1 Gm.), U. S. P.]

Sōdii Bicarbōnas - Sōdii Bicarbonātis - Sodium Bicarbonate. U. S. P.

Origin. It is obtained by neutralizing a mixture of 2 parts of crystalline and 3 parts of anhydrous sodium carbonate with carbon dioxide gas, produced by the action of hydrochloric acid on calcium carbonate. The resulting salt is dried by the action of heat and the weight of the dried water, the anhydrous part being dried by exposure to heat.

Description and Properties.—A white powder, cooling, mildly alkaline taste, permanent in air. Soluble in 12 parts of water at 20° C. the solution loses carbon dioxide, and at a higher temperature into normal carbonate. Insoluble in alcohol and in well closed vessels, in a cool place.

Dose.—10–30 grains (0.6–2.0 Gm) [15 g]

Official Preparation

Mistura Rhēi et Sōdæ—Mistura Rhēi et Sōdæ.—*Dose*, ½–2 fluidounces (7.4–59 Cc) [

Trochisci Sōdii Bicarbonatis—Trochisci Sōdii Bicarbonatis.—*Dose*, 1

Pulvis Effervescens Compōsitus—Pulvis Effervescens Compōsitus.—*Dose*, 1

Effervescent Powder.—*Verbatim*: Potassium and sodium tartrate, 9; tartaric acid, 27

Dose.—Set of 2 powders. To be dissolved and taken while effervescing

Sōdii Carbōnas Monohydrātus—Monohydrate. U. S. P.

Origin.—Obtained from sodium sulphate by a complicated process, known as *Lefblanc's*, from chalk and coal, the mixture ignited, and the concentrated, the carbonate separating from the

Description and Properties.—Soluble in 0.09 part at 38° C. (100.4 F.). in 1.8 parts of glycerin; insoluble in alcohol and ether. "Reaction with litmus-paper, and effervesces when kept in well closed vessels.

Dose.—2–15 grains (0.0125–1.0 Gm) [

The sodium carbonate contained 10 molecules of water. part of this was lost on exposure to air, strength. The sodium carbonate exsiccatus probably corresponded to the formula Na_2CO_3 hygroscopic. The monohydrated salt does not absorb much moisture. It is, therefore, different from the others.

Sōdli Cītras—Sōdli Citratum. U. S.

Description and Properties.— $2\text{Na}_2\text{C}_6\text{H}_5\text{O}_7 + 11\text{H}_2\text{O}$. It slowly effloresces in parts of cold water and in 0.4 part of boiling

Dose.—Average dose: 15 grains (1 Gm)

Sōdli Phōsphas Exsiccātus—Exsiccated Sodium Phosphate

Description and Properties.—This is sodium phosphate, Na_2HPO_4 ; it is obtained by driving off water from sodium phosphate (U. S. P.), which amounts to 60% of the weight of the exsiccated salt there are 40% of phosphate as in the same weight of the crystals absorbs moisture readily when exposed to the

salt of the composition $\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$, which contains about 47 per cent. of water, the latter salt is permanent.

Dose.—Average dose—15 grains (1 Gm.), U. S. P.

Södlil Phösphas Effervescens—Södlil Phosphätis Effervescentis—Effervescent Sodium Phosphate. U. S. P.

Description and Properties.—Compound of the saturated sodium phosphate, sodium bicarbonate and tartaric acid. It contains sufficient sodium bicarbonate to neutralize the tartaric acid when it is dissolved in water, and the carbonic acid gas liberated gives a pleasant acidulous and effervescent taste.

Dose.—Average dose—120 grains (8 Gm.), U. S. P.

POTASSIUM COMPOUNDS.

Liquor Potassii Hydröxidi—Liquöris Potässii Hydröxidi—Solution of Potassium Hydroxide. U. S. P.

Origin.—An aqueous solution containing about 5 per cent. of potassium hydroxide.

Description and Properties.—A clear, colorless liquid, and more than 5 is very caustic and caustic taste and a strongly alkaline reaction. It should conform to the same reaction and tests as an aqueous solution of potassa. (See Potassa.)

Dose.—5–60 minims (10–3.125 Cc.), well diluted (15 minims (1 Cc.), U. S. P.).

Potässii Äcetas—Potässii Acetätis—Potassium Acetate. U. S. P.

Origin.—Prepared by the action of acetic acid upon potassium carbonate.

Description and Properties.—A white powder or crystalline masses of a sat. luster, soluble, and having a warm, saline taste. Very deliquescent, exposing to the air. Soluble in 5 parts of water and in 10 parts of alcohol with increasing temperature it becomes more soluble in both liquids. Potassium acetate should be white in well stoppered bottles.

Dose.—15–60 grains (1.0–4.0 Gm.) (30 grains (2 Gm.), U. S. P.)

Potässii Bicarbõnas—Potässii Bicarbonätis—Potassium Bicarbonate. U. S. P.

Origin.—Prepared by the action of carbon dioxide upon a solution of the carbonate.

Description and Properties.—A white, translucent, granular powder, od. free, and having a warm and slightly caustic taste. It contains 100 parts soluble in 32 parts of water at 16° C. (59° F.) and 100 parts at 60° C. (140° F.). At a higher temperature the solution rapidly loses carbon dioxide and, consequently, contains a potassium alkali. It is almost insoluble in alcohol. The drug should be kept in well stoppered bottles.

Dose.—15–60 grains (1.0–4.0 Gm.) (30 grains (2 Gm.), U. S. P.)

Potässii Bitartras—Potässii Bitarträtis—Potassium Bitartrate. U. S. P.

(CREAM OF TARTAR.)

Origin.—Prepared by purifying and crystallizing argemone or crude tartar a combination of grape stems and leaves.

Description and Properties.—A colorless or slightly pinkish, rhombic crystals,

or a white, somewhat gritty powder, odorless, and permanent in the air. Soluble in about 200 parts of boiling water; very slightly soluble in alcohol.

Dose.—10 grains (1/2 ounce) (0.6-16.0 Gm.)

Official Preparation

Pulvis Jalapæ Compositus—Pulvis Jalapæ
 Powder of Jalap. **Dose.** 10-30 grains (0.6-2.0 Gm.)
 as a hydragogue cathartic.

Potassii Carbōnas—Potassium Carbonate

Origin.—Prepared from the ash obtained from the distillation of wood.

Description and Properties.—A white powder, having a strongly alkaline taste, very deliquescent at 25° C (77° F.) and in about 0.65 part of aqueous solution (1-20) has a strongly alkaline reaction. Effervesces with acids. Potassium carbonate should be kept in well-stoppered bottles.

Dose.—5-30 grains (0.3-2.0 Gm.) (10 grs.)

Potassii Citras—Potassium Citrate. U. S. P.

Origin.—Prepared by the action of citric acid on potassium carbonate.

Description and Properties.—A white, granular powder, odorless, and having a cooling, slightly bitter taste. Soluble in 0.5 part of water at 25° C (77° F.), feebly soluble in alcohol. Potassium citrate should be kept in well-stoppered bottles.

Dose.—15-60 grains (1.0-4.0 Gm.) (15 grs.)

Official Preparations

Potassii Citras Effervescens—Potassium Citrate Effervescent.—Potassium citrate, 252; citric acid, 162.

Dose.—7-45 grains (0.4-3.0 Gm.)

Liquor Potassii Citratis—Liquor Potassii Citratis.—An aqueous liquid containing not less than 10 per cent of potassium citrate. To be made freshly when wanted.

Dose.—1/2-1 ounce (15-30 cc.) (4 drams)

PREPARATIONS

Calcii Carbōnas Præcipitatus—Precipitated Calcium Carbonate. U. S. P.

Origin.—Prepared by mixing aqueous solutions of calcium chloride and sodium carbonate, the resulting precipitate of calcium carbonate is washed and dried.

Description and Properties.—A white, granular powder, permanent in the air. Nearly insoluble in water, but soluble in presence of ammonium salts, and especially by hydrochloric acid. Insoluble in alcohol, but in diluted hydrochloric acid is completely soluble, with effervescence.

Dose.—15-30 grains (1.0-2.0 Gm.) (15 grs.)

Crēta Præparāta—Crētæ Præparātæ—Prepared Chalk. U. S. P.

Origin. Native calcium carbonate, freed from most impurities by elutriation.

Description and Properties.—A white, amorphous powder, often milled into coarse lumps, odourless, and tasteless, permanent in the air. A most insoluble in water; insoluble in alcohol, soluble in dilute acids, hydrochloric, or nitric acid, with effervescence, but without leaving more than a faint residue.

Dose.—5-60 grains (0.3-4.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Official Preparations.

Hydrargyrum cum Crēta—Hydrargyri cum Crētæ—Mercury with Chalk.—*Dose*, 2-20 grains (0.13-0.6 Gm.) [4 grains (0.25 Gm.), U. S. P.] (Described under Hydrargyrum.)

Pulvis Crētæ Compositus—Pulveris Crētæ Compositi—Compound Chalk Powder. *Dose*, 20-60 grains (1.3-4.0 Gm.) [30 grains (2 Gm.), U. S. P.].

Liquor Calcis—Liquōris Calcis—Solution of Calcium Hydroxide. U. S. P.

(SOLUTION OF CALCIUM HYDROXIDE, LIME WATER.)

Origin.—A saturated aqueous solution which should contain not less than 0.24 per cent of pure calcium hydroxide.

Description and Properties.—A clear, colorless liquid, without odour, and having a saline and freely caustic taste. It absorbs carbon dioxide from the air, so that a pellicle of calcium carbonate forms on the surface of the liquid. On being heated it becomes thickened through separation of calcium hydroxide which redissolves when the liquid is cooled. It gives a strong alkaline reaction with litmus paper.

Dose.—2-4 ounces (55-110.3 Gm.) [4 fluidrams (16 Gm.), U. S. P.].

Official Preparations.

Linimentum Calcis—Linimentū Calcis—Lime Liniment (CARBON OIL).—*Preparation*, 1 part of lime water to 10 parts of carbon oil.

Mistura Crētæ—Mistūræ Crētæ—Chalk Mixture.—Compound chalk powder, 10 parts; distilled water, 100 parts.

Dose, 1-4 fluidrams (4.0-16.0 Gm.) [4 drams (16 Gm.), U. S. P.].

Syrupus Calcis—Syrupū Calcis—Syrup of Lime.—*Dose*, 1/2-2 fluidrams (1.2-7.4 Gm.) [30 minims (2 Gm.), U. S. P.].

PREPARATIONS OF LITHIUM.

Lithii Carbōnas—Lithii Carbonātis—Lithium Carbonate. U. S. P.

Origin. Lithium is found in many mineral waters, the carbonate being prepared from them.

Description and Properties.—A light, white powder, odourless, and having an effervescent taste, permanent in the air. Soluble in 70 parts of water and 14 parts of boiling water; insoluble in alcohol. In water saturated with carbon dioxide, insoluble as such, but soluble in carbonic acids, or when carbon dioxide is added.

Dose.—2-10 grains (0.13-0.6 Gm.) [7 grains (0.5 Gm.), U. S. P.].

Lithii Citras—Lithii Citra U. S.

Origin.—Prepared by adding lithium ca-

Description and Properties.—A w
ing faintly alkaline taste; deliquescent on ex
water and in 15 parts of boiling water; almost
citrate should be kept in well stoppered bottle

Dose.—2-10 grains (0.12-0.6 Gm.) [7%]

Official Pre

Lithii Citras Effervescens—Lithii C
Lithium Citrate.—**Dose.**—1-2 drams (4.0-8

PREPARATIONS C

Magnēsii Ōxidum—Magn U. S.

(LIGHT MAGNESIA; Ca

Origin.—Prepared by subjecting magne
ash or Hessian crucible closed loosely by a li

Description and Properties.—A
without odor, and having an earthy, but s
air it slowly absorbs moisture and carbon
insoluble in alcohol, but soluble in diluted
closed vessels

Dose.—As an antacid, 10-15 grains (0.

Magnēsii Ōxidum Ponde Ponderosi—Heavy I

(HEAVY M

A white, dense, and very fine powder, w
tests for magnesia, from which it differs in
gelatinous hydrate.

Official Pre

Pulvis Rhēi Compōsitum—Pulvērīa
of Rhubarb.—**Formula** Rhubarb, 25, ma

Dose—As a laxative, 20-60 grains (1.3-

Magnēsii Carbōnas—M Magnesium Cart

Origin.—Prepared by evaporating to c
sulphate and sodium carbonate, and purifyin

Description and Properties.—Li
powder, without odor, and having a slight
Almost insoluble in water, to which, howev
insoluble in alcohol, but soluble in diluted a

Dose.—As an antacid, 5-20 grains (0.

Official Preparation.

Liquor Magnēsi Citrātis—Liquōris Magnēsi Citrātis—Solution of Magnesium Citrate. A liquid of magnesium carbonate, citric acid, and potassium bicarbonate, widely used as a pleasant laxative.

Dose.—2-12 ounces (60-360 Cc.).

Magnēsii Sūlphas—Magnēsii Sulphātis—Magnesium Sulphate.

See Cathartics.

PREPARATIONS OF AMMONIUM.

Ammōnii Carbōnas—Ammōnii Carbonātis—Ammonium Carbonate. U. S. P.

Origin.—Prepared by a complicated process by heating in an iron or earthen retort a mixture of sal ammoniac and chalk.

Description and Properties.—White, hard, translucent, striated masses having a strongly ammoniacal odor without exposure, and a sharp, saline taste. On exposure to the air the salt loses both ammonia and carbonic acid, becoming opaque, and is finally converted into friable porous lumps or a white powder. Soluble but completely insoluble in about 5 parts of water at 16° (59° F.), and decomposed by hot water, with the evolution of carbonic acid and ammonia. By prolonged boiling with water the salt is completely dissipated. The aqueous solution possesses a strong alkaline reaction and effervesces with acids.

Dose.—3-10 grains (0.18-0.6 Gm.)

Official Preparation.

Spiritus Ammōniæ Aromāticus—Spiritus Ammōniæ Aromātici—Aromatic Spirit of Ammonia. Composition: Ammonium carbonate, ammonia water, aromatic oils, alcohol, and water.

Description and Properties.—A nearly colorless liquid when freshly prepared but gradually acquiring a somewhat darker tint. It has a pungent, ammoniacal odor and taste.

Dose.— $\frac{1}{2}$ -1 fluidram (1.5-3.7 Cc.) [30 minims (2 Cc.), U. S. P.]

Antagonists and Incompatibles.—The alkalis and their carbonates are incompatible with acids and with metallic salts. The ammonium carbonate is incompatible with the acidulous salts and with lime water.

Synergists.—Agents promoting waste, such as vegetable acids, mercury, iodine, etc., increase the therapeutic activity of the alkalis.

Physiological Action.—The alkalis mentioned in this group may be divided into *direct antacids*, or those which neutralize or lessen the acidity of the stomach, and *indirect antacids*, or those which, being oxidized in the blood, are excreted as carbonates, diminishing the acidity of the urine and increasing the alkalinity of the blood, although not influencing the acidity in the stomach.

The *direct antacids* are lime water, prepared chalk, and magnesia.

The *indirect antacids* are potassium acetate, bitartrate, citrate, and tartrate, sodium acetate, and lithium citrate.

The following alkalies are both in solution of potassa, solution of soda, of potassium, sodium, lithium, magnesium.

The physiological action of the alkalies is considered in detail.

Externally and Locally.—The alkalies are caustic and rubefacient. The caustic alkalies when applied undiluted, irritate the skin and dissolve the epidermis and the albumin of the various structures of the skin. The carbonates and bicarbonates have a much weaker action, while the tartarates have no local influence.

The ammonium salts do not affect the skin as those previously mentioned, but they irritate the underlying structures, thus acting as vesicants. If ammonia be applied to the skin, suppuration and sloughing may ensue.

Internally.—Digestive System.—The alkalies promote the secretion of gastric juice, increase the acidity of the gastric juice, and, by rendering the gastric juice alkaline, interfere with the secretion of the intestines, thereby deranging digestion.

The statement that alkaline salts increase the secretion of gastric juice is a mere interpretation than on experiment. The so-called "law of compensation" has little foundation in experiment. The results sometimes obtained must be explained on other grounds.

Circulatory System.—The alkalies increase the acidity of the gastric juice, and increase the alkalinity of the blood. When taken in large doses upon an empty stomach, the blood is unchanged, where, by decomposition, sodium present, they form the acetates, increasing the alkalinity of the blood and interfering with the secretion of the intestines.

The acetates, citrates, and bitartrates. The acid radical being destroyed, carbon dioxide formed, the salts become carbonates, increasing the alkalinity of the blood.

Should the caustic alkalies be taken in large doses, death quickly ensues from coagulation of the blood. Should excessive formation of alkali occur, as in the case of the poisonous doses the heart-muscle is paralyzed, and its contractions, arrest taking place. Should the doses, if long continued, may occur, the force of the circulation is diminished, the blood-pressure, though the pulse-rate be

potassium salts applied to muscle diminish or paralyze its contractile power.

Nervous System.—When potassium salts are administered in medicinal doses and for a reasonable length of time, no important action upon the nervous system is produced, but if excessive doses be taken, the nerve-centers and motor nerves are paralyzed, after a period of temporary excitement. Owing, however, to the fact that potassium is a protoplasmic poison, affecting alike the muscles and nerve-tissues, its salts should not be given in full doses for too long a period without counteracting their depressing influence by the use of muscle and nerve-tonics.

Respiratory System.—The only action of importance upon the respiratory system is the increased amount and diminished viscosity of the secretion from the bronchial tubes.

Absorption and Elimination.—The potassium salts possess very high diffusive power. They are easily and quickly absorbed and rapidly excreted, the salts with vegetable acids being eliminated as alkaline carbonates, rendering the urine alkaline. Salts of potassium are chiefly eliminated by the kidneys, though the process takes place to some extent through the bronchial mucous membrane and other secretions. They are active diuretics, increasing the amount of water and, by stimulating the renal epithelium, augmenting the excretion of solids. The uric acid is greatly diminished, being converted into urea, and as such eliminated, showing that the alkalies increase oxidation and promote catabolism.

Temperature.—Medicinal doses have no effect upon temperature.

Intestinal Action.—Under prolonged dosage the digestion becomes impaired. There is present paralysis of the muscular fibers of the intestines, accompanied by diarrhea or constipation and tympanites. There may be also present emaciation, muscular weakness, nervous prostration, and anemia.

Poisoning.—The caustic preparations of sodium and potassium produce the symptoms of the corrosive poisons, resembling the poisonous action of the mineral acids to be described. Death is occasionally preceded by convulsions, the heart's action being arrested before respiratory failure. The carbonates and bicarbonates and the salts of vegetable acids are not considered poisonous, nor do they produce the corrosive effects of caustic potash or its solution.

Treatment of Poisoning.—Vegetable acids are chemically incompatible, and should be given freely, together with oils and demulcent drinks as protectives, and, if in it necessary, to relieve pain (arises stimulants—digitalis, brandy, caffeine, etc.—may be required to sustain the heart, to be given hypodermically).

The Comparative Action of the Alkalies.—Sodium salts in their action are analogous to potassium, although less irritating to the gastro-intestinal tract. They are also less depressing to the circulatory, muscular, and nervous systems.

Lithium salts closely resemble in their effects those of potassium their action upon the nerves and muscles, however, being

less powerful. The contractile force is diminished by lithium and increased as lithium in gout. The large amount usually given is the most potent factor.

CALCIUM SALTS are more sedative upon the gastro-intestinal tract than direct antacids. They tend to produce alkalies, and muscular systems are less affected. In remaining alkalies, the contractile force is increased by calcium. They are less potent than the foregoing alkalies, and less affect the quantity of the urine. They are useful in gout.

MAGNESIUM SALTS.—Magnesia is a direct antacid and sedative to the intestinal canal as saline cathartics. In the circulatory system they are feeble. Magnesium salts, slightly increasing the force of the heart, are not so readily absorbed, nor is the action of potassium and sodium, while in the solids excreted.

AMMONIUM SALTS.—These preparations are diac stimulants, their physiological action is considered under that group. A comparison of the action of the gastric juice and its secretion with that of the ammonium and bicarbonates already mentioned of the stomach, augmenting the force of the heart, increasing the sensation of warmth in the epigastrium. They increase the glycogenic function of the liver, the circulatory system, elevating the blood pressure. In medicinal doses they relax the nerves, and muscles, while toxic doses are paralytic. They prevent the coagulation of the blood, and the carrying power of the red corpuscles are increased in frequency.

The salts of ammonium are quickly eliminated from the body, augmenting the quantity of the urine, thereby increasing its alkalinity.

As regards the poisonous action of ammonium ranks, next to potassium.

Therapeutics.—*Externally* a saturated solution of LIQUOR POTASSÆ in water is applied to the nail, which is soon removed and scraped without causing pain. It is also employed in the treatment of *diseases of the skin* to allay itching. It is also employed extensively in the proportion of 1 part to 10 parts of water in softening impacted cerumen.

The POTASSIUM CARBONATE in solution

pruriginous diseases of the skin, being a highly efficient antipruritic.

The detergent and sialagogue properties of POTASSIUM CITRATE and TARTRATE are rendered serviceable in certain diseases of the mouth.

SODIUM BICARBONATE is a deservedly popular dressing for *burns*, and *pain and swelling of the joints in acute articular rheumatism* are sometimes greatly relieved by enveloping the articulations in a hot solution rendered alkaline with this salt. In diseases of the ear it is used for the same purposes as the potassium preparations above mentioned. It is one of the ingredients of "Hobell's Solution," which is an effective antiseptic wash in *nasal catarrh*, and the solution of sodium bicarbonate has been suggested as a valuable remedy in *thrush* or *aphthae*.

SODIUM CARBONATE may be used for the same purposes as the bicarbonate, though probably inferior to it in all cases save *infantile eczema capitis*, in which condition it is a most valuable remedy for softening the eczematous crusts.

PREPARED CHALK is an ingredient of many ointments used in the treatment of *erysipelas* and *subacute eczema*. LIME WATER, mixed with equal parts of linseed or olive oil, is highly prized as a dressing for *burns*, and the efficiency of the "black" and "yellow" washes in the treatment of venereal sores is too well known to require further testimony in their favor. These calcium preparations also make excellent applications in *acute eczema*. Lime water may sometimes be used with advantage in *impetigo herpetica* and *scabies*.

MAGNESIUM CARBONATE makes an efficient dusting powder in *dermatitis* and *irritable conditions of the skin*. AMMONIUM CARBONATE mixed with lanolin readily dissolves the epidermic scales of *psoriasis*, and the AROMATIC SPIRIT OF AMMONIA is a grateful application to the scalp in *psoriasis*.

Internally—Ingestive System.—The carbonates and bicarbonates, when given before meals, serve to increase the flow of gastric juice. They act as secretives to the stomach, particularly in *partial conditions* arising from a *deficient secretion of gastric juice*. As antacids, when given after meals, they are very useful in counteracting *excessive acidity of the stomach*. The acidity due to the formation of fatty acids, the result of defective digestion, is not relieved by the administration of these salts after meals, but if taken before meals they are valuable in correcting the deficiency of gastric secretion, to which the disordered digestion is due. In *stomach dyspepsia* these preparations administered with vegetable bitters serve a useful purpose.

The bicarbonates and the salts of the vegetable acids are of some value in *gout*, possibly from changes in the composition of the blood, possibly by reason of the copious diuresis set up by the water and salt action. They are also of benefit occasionally in the treatment of *acute rheumatism*. Butler is of the opinion that in the treatment of acute rheumatic arthritis alkalies are far superior to any other drugs, salicylic acid not excepted.

While it is admitted that the treatment with alkalies alone will not shorten the course of the disease, as the employment of salicylates, by diminishing the danger of heart-complications, the fever is reduced, and the tendency to reabsorption of alkaline remedies.

The acetates, bitartrates, and citrates, cathartics, and diaphoretics, the furoic acid, the diuretics, the POTASSIUM BITARTRATE, the citrates active diaphoretics.

In *chronic Bright's disease* the acetates are indicated for their diuretic action, and the citrates one of the most effective cathartics and *cardiac dropsy*.

LIME WATER is a useful remedy in *gastric irritability*, *gastric ulcer*, or *cancer*—this symptom in *pulmonary tuberculosis*, in *vomiting*, in preventing the formation of *calcium phosphate*.

In the *acute mycotic diarrhea* of *gastro-intestinal fermentation*, the lime water is indicated. The symptoms also of *chronic diarrhea* are mitigated by this simple remedy.

LIME WATER is without doubt a *simple*, and may also exert a *favorable effect* by checking and otherwise it. It should be remembered that this is not the case in *arsenical poisoning*. The sugar which it contains is a *remedy*, the sugar which it contains is a *remedy*, the action which the lime alone might exert.

PREPARED CHALK, OR CHALK MIXTURE, is a *remedy* in *premonitory diarrhea of cholera*, a *remedy* with greenish acid stools and flatulence. They are greatly benefited by this preparation, however, that the chalk mixture by itself, water it contains being liable with *acid* and the propagation of micro-organisms, aggravate the condition for which it is intended, vomiting etc. This old standby is still used in *later-day pediatrics* by the use of *septica*. Chalk mixture is still used in *to bacterial causes*.

MAGNESIA is an invaluable antacid, especially in *aphthæ* attending infantile *diarrhea*.

The AMMONIUM PREPARATIONS are *early efficacious* in the *dyspepsia* of *gastric irritation*, render the mucus less viscid, and improve the circulation. Their excitant quality is of modifying the mucous secretion.

appropriate cases of *subacute* and *chronic bronchitis*. In cardiac therapy the ammonium compounds are valuable as quick diffusible stimulants.

In conclusion, it may be well to mention the values of alkalies in *aiding the digestion of fats*, and as efficient remedies in the dyspepsia and indigestion from which obese, gouty, and rheumatic subjects frequently suffer.

The virtue and uses of mineral waters will be fully discussed in the group devoted to the subject. The use of many of the alkaline salines is further discussed under the heading *Cathartics*.

Administration.—The alkalies should invariably be administered largely diluted, thus favoring absorption and preventing their irritant action upon the gastro-intestinal mucous membrane. The time of administration—whether before or after meals—will depend entirely upon the effect desired, a thorough knowledge of their action as above given being necessary to an intelligent and proper use of the various preparations.

NITRATES.

Potassii Nitras Potassii Nitrâtis—Potassium Nitrate. U. S. P.

(NITRE, SALTPETRE.)

Origin—Derived from native saltpetre.

Description and Properties—Colorless, crystalline grains or a crystalline powder, colorless, and having a cooling taste and no odor. Permeable in the air. Soluble in 15 parts of water, very soluble in 100 parts of alcohol.

Dose.—3-30 grains (0.3-2.0 Gm.) (7½ grains (0.5 Gm.) U. S. P.)

Antagonists and Incompatibles.—Cardiac and diffusible stimulants antagonize the action of potassium nitrate upon the heart. Mineral acids and metallic salts are incompatible.

Synergists.—The cardiac depressants, diuretics, and agents increasing waste.

The action of the nitrates is in the main, like the salts. There is thought to be a distinct nitrate ion action.

Physiological Action—*Externally and Locally*.—The taste is cool and salty and the nitrates increase the flow of saliva.

Internally.—**Digestive System.**—Large doses occasion nausea and vomiting; poisonous doses produce violent gastro-intestinal inflammation and diarrhea, blood sometimes being vomited and passed with the stools.

Circulatory System.—Small doses have no marked influence on the circulatory system. Small doses act as a cardiac depressant, slowing and weakening the pulse; poisonous doses produce great weakness, syncope, and death from cardiac failure. These results are possibly due to the action of the potassium ion.

Nervous System.—No special actions. Poisonous doses produce tremulousness.

Respiratory System.—Large doses

Absorption and Elimination.—Pot into the blood unchanged, and is ex changed. Small doses are actively cells. Large amounts, from too free and inflame the kidneys, even so far drug is also eliminated to some extent a mild diaphoretic.

Temperature.—Unaffected by moderate by poisonous doses.

Poisoning.—There is violent gastric vomiting and purging, blood being Other symptoms are—subnormal temperature, a weak and thready pulse, tremulousness and great muscular weakness. total blindness, deafness, insensibility. The urine is diminished or suppressed.

Should the patient recover from poisoning he suffers for some time from dysuria, colic, muscular weakness, and a numbness of the limbs.

Treatment of Poisoning.—There are many cases of poisoning, therefore, are various measures for relief including evacuation of opiates for pain, and cardiac and respiratory.

Therapeutics.—*Externally and Internally.*—have been found serviceable as applied. The last stage of *pharyngitis* is given. SOLUTION OF POTASSIUM NITRATE, (4.0 Gm.) to 1 pint (473 Cc.) of water.

It is claimed that a paste of rowan to the face night and morning is an *freckles*. Suffice it to say it is not a

The difficulty of breathing in case of at times relieved by the inhalation of POTASSIUM NITRATE PAPER.

Internally.—The drug was formerly used in *rheumatism* and as a refrigerant in *pneumonia*, and various *fevers*. It is also used to some extent as a diuretic and diaphoretic, in the form of acetates and citrates.

Administration.—It should be given in powder is sometimes used in combination with ipecac, or Dover's powder.

The potassium-nitrate paper, when burned and the fumes arising therefrom

Södlil Niträs—Södlil Niträtis—Sodium Nitrate.**U. S. P.**

Origin.—It is found in great quantities imbedded in clay and sand in certain districts of Chili and Peru.

Description and Properties.—Colorless, transparent, rhomboidal crystals, odourless, having a cooling, saline, and slightly bitter taste. It dissolves in 13 parts of water and in about 100 parts of alcohol. Sodium nitrate should be kept in well-stoppered bottles.

Dose.— \frac{ss} –1 ounce (15.5–31.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Physiological Action.—The action of the salt resembles closely that of potassium nitrate, though it is much feebler than the latter drug, particularly being less depressing to the heart muscle and in possessing greater purgative properties.

Therapeutics.—*Externally and locally.*—A solution of the salt possesses some power as a solvent of false membranes, and has been used in the form of a spray to diminish *perious exudations* in the pharynx and larynx.

Internally.—It may be employed for the same purpose as the potassium nitrate and has been advantageously adopted as a laxative in *diarrhea* and *dysenteria*.

Administration.—Sodium nitrate is best given dissolved in a large quantity of water.

MINERAL WATERS.

The line of demarcation between mineral and ordinary waters cannot be definitely drawn. Although in the former there is usually present an increase of mineral constituents or of temperature, some drinking waters contain more mineral ingredients than others, while many very pure waters, both cold and warm, have been regarded for ages as mineral springs.

Although especially abundant in volcanic regions, mineral springs are by no means confined to them. They have been found on alpine heights—even at the snow-line in the Himalayas—and they rise from the bottom of the sea, as at Rahr and Ischia.

The foreign ingredients of mineral waters, as shown by analysis, are very numerous, some of them occurring in exceedingly minute, others in large, quantities. Among them are soda, magnesium, calcium, potash, alumina, iron, boron, iodine, bromine, arsenic, lithium, cesium, rubidium, fluorine, barium, copper, zinc, manganese, strontium, silica, phosphorus, besides extractive substances and various organic deposits known under various names. The constituent gases include carbonic and hydro-sulphuric acids, nitrogen, oxygen, hydrogen, and ammonia. Of all these by far the most important from a therapeutic point of view are sodium, magnesium, iron, carbonic acid, sulphur, and perhaps hydrosulphuric acid.

These combinations are very numerous, from 10 to 20 per cent. of them; yet the dominating constituents which mark the type of the water are few, while many substances, such as cesium and strontium, are present in mere traces and must be regarded as accessories.

Mineral waters may be considered as stronger solutions of salts and gases of the same kind, although the quantity of saline ingredients is in a very small proportion of that of the sea water. For the purposes of therapy they are used either externally as baths or internally as beverages. With the exception, or, to speak technically, balneotherapy, work precludes treatment *in extenso*, and under such conditions the system is undoubtedly influenced by a number of various characters, especially when combined with the aid of well-considered diet and regime.

The literature connected with the hydrotherapy is voluminous, yet the deductions drawn from it are few, owing to the fact that the results of the springs are too frequently colored by the bias of the too hasty analysis to furnish infallible statements. The statement possible in ordinary therapy is that charged with foreign ingredients which act upon the body favorably in the case of certain diseases, and deny. Yet even here there are subsidiary influences ignored; and it is an open question whether the results are relieved by the potency of the remedies, or by the lateral aids of environment, climate, and the influence of the not have an important bearing upon the results.

It has been well observed that in the case of the curative atmosphere of the surrounding country, the reflex influence of the climate, the influence of the sun, from customary cares, aided by the influence of the medical supervision, play no unimportant part in the positive or imaginary disorders. The influence of the "and let nature work the cure," seems to be the result of many fashionable resorts where a combination of the practical, though imperceptible, tonic influence of certain nervous susceptibilities, and the less forcible in the case of American resorts, and those of the more famous resorts of Europe.

Various attempts have been made to classify the waters according to their therapeutic action, but the results are effects physiologically, and, most frequently, according to their chemical composition. Yet their influence upon the body, their idiosyncrasy and their constituents make it impossible to select a definite system of classification, and a scientific classification, uniformly adopted, to promote their rational employment.

practically earthy or saline ones, yet the presence of minute quantities of hydrosulphuric acid, an ingredient so palpable as always to attract attention, has determined a classification obviously at variance with natural fact. The general rule has been to class waters under the head of their predominating elements, the desideratum being comparative simplicity untrammelled by theoretical considerations.

ALKALINE.—These waters owe their chief therapeutic value to the alkaline salts they contain. They are rich in alkaline carbonates, especially the sodium carbonate. Other substances are included among their ingredients, many of them strongly charged with carbonic-acid gas, which may possibly contribute to their physiological activity.

SALINE.—These either contain (1) chloride of sodium as the principal ingredient, or (2) are largely impregnated with the sulphates of sodium and magnesium. Several other ingredients enter into their composition, yet their efficacy chiefly depends upon their predominating elements; the second class includes the bitter or purgative waters highly prized both in this country and abroad.

SULPHURETTED.—The sulphuretted hydrogen present in these waters lends to them their chief therapeutic value. They contain also various sulphides—of potassium, sodium, calcium, and magnesium—together with earthy and other sulphates, which doubtless contribute in a measure to their potency as physiological agents, although their action upon the system is still a matter of conjecture.

CHALVATE.—Many mineral springs contain iron, yet in amounts so insignificant as to be of little value to therapy. There are, however, chalybeate waters highly charged with iron salts in the form of the carbonate or sulphate which have acquired a reputation for efficacy in the treatment of certain diseases.

ACIDULOUS.—The valuable property of these springs lies in the superabundance of carbonic-acid gas they contain, to which the solid constituents are subordinate, the carbon dioxide being the important therapeutic ingredient.

CALCARIOUS.—Calcium, in the form of the carbonate, is the valuable constituent of cal-careous waters. Besides this substance they contain magnesium carbonate in varying quantities. Their utility as mineral waters has been questioned, many authorities refusing them recognition as therapeutic agents.

The following enumeration of native springs is from the admirable list compiled by Dr. A. N. Bell.

Alkaline.

Adams, California
Albany, Vermont
Alma, Michigan
Alum, Virginia.

Berkshire, Vermont
Borax, California
Blount, Alabama
Canon City, Colorado
Caracas, Colombia
Congress, California.

Elgin, Vermont.
 Fry's Soda, California.
 Greencastle, Indiana.
 Highgate, Vermont.
 Highland, California.
 Kittrell's, North Carolina.
 Lower Soda, California.
 Madison, Georgia.
 Manitou, Colorado.
 Manley, North Carolina.
 Middletown, Vermont.
 Milford, New Hampshire.
 Montvale, Tennessee.
 Napa Soda, California.
 Newbury, Vermont.
 Owasso, Michigan.
 Perry, Illinois.
 Ravenden, Arkansas.
 Rocky Mountain, Colorado.
 Rowland's, Georgia.
 Schooley's Mountain, New Jersey.
 Schuyler County, Illinois.
 South Park, Colorado.
 Sparta, Wisconsin.
 Versailles, Indiana.

Purgative Saline :

Alma, Michigan.
 Blue Lick, Kentucky.
 Crab Orchard, Kentucky.
 Elgin, Vermont.
 Esculapian, Kentucky.
 Harrodsburg, Kentucky.
 Midland, Michigan.
 Pagosa, Colorado.

Saline :

Fruit-Port Well, Michigan.
 Grand Haven, Michigan.
 Louisville Artesian, Kentucky.
 Michigan Congress, Michigan.
 Mt. Clemens, Michigan.
 Ocean, Alabama.
 St. Louis, Missouri.
 Salt, Virginia.

Spring Lake Well, Michigan.

Sulphurous :

Alpena, Michigan.
 Balston, New York.
 Bladon, Florida.
 Blue Lick, Kentucky.
 Carlisle, Pennsylvania.
 De Soto, Louisiana.
 Sheldon, Vermont.
 Summit, Maine.

Thermal Springs :

Agua Caliente, New Mexico.
 Arrow-Head, California.
 Buncombe County, North Carolina.
 Calistoga, California.
 Chalk Creek Hot, Colorado.
 Charleston Artesian, South Carolina.
 Des Cahutes Hot, Oregon.
 Seltzer, California.
 Sheldon, Vermont.
 Summit Soda, California.
 Vichy, California.
 Wilholt Soda, California.

Calcic :

Bethesda, Wisconsin.
 Butterworth, Michigan.
 Birch-Dale, Vermont.
 Clarendon, Vermont.
 Eaton Rapid, Michigan.
 Gettysburg, Pennsylvania.
 Hubbardstown, Michigan.
 Silurian, Wisconsin.

Chalybeate :

Abbeville, South Carolina.
 Alma, Michigan.
 Bedford, Pennsylvania.
 Blossburg, Pennsylvania.
 Cooper's Well, Mississippi.
 Esbitt, Kentucky.
 Fayette, Pennsylvania.

Dremion, Kentucky.
 French Lick, Indiana.
 Glenn's, South Carolina.
 Gordon's, Georgia.
 Highgate, Vermont.
 Indian, Georgia.
 Indian, Indiana.
 Lodi Artesian, Indiana.
 Manley, North Carolina.
 Minnequa, Pennsylvania.
 Montesano, Missouri.
 Olympian, Kentucky.
 Portea Springs, Colorado.
 Salt Sulphur, Virginia.
 Saratoga, New York.
 Sharon, New York.
 Sheldon, Vermont.
 Shocco, North Carolina.
 St. Helena White Sulphur,
 California.
 St. Louis, Michigan.
 Sweet, Missouri.
 Valhemos, Alabama.
 West Baden, Indiana.
 White Sulphur, Louisiana.
 White Sulphur, Montana.
 White Sulphur, Virginia.

Unclassified:

Alum, Virginia.
 Birch-Dale, New Hampshire.
 Borax, California.
 Climax, Missouri.
 Eureka, Arkansas.
 Fairview, Texas.
 Geysers, the American, Wyo-
 ning.
 Geyser Spa, California.
 Greencastle, Florida.
 Harbines, California.
 Hot Springs, Arkansas.
 Idaho Hot, Colorado.
 Iodide and Bromide, Missouri.
 Merriweather, Georgia.
 Middle Park Hot, Colorado.
 Ojo Caliente, New Mexico.
 Paraiso, California.
 Passo Robies, California.
 Piedmont, Texas.
 Salt Lake, Utah.
 Scigler, California.
 Slaggs, California.
 Stafford, Connecticut.
 Volcano, Nebraska.
 Warm and Hot, West Virginia.

DRUGS ACTING CHIEFLY ON THE GASTRO- INTESTINAL ORGANS.

BITTERS.

SIMPLE BITTERS.

Quässia—Quässisæ—Quassia. U. S. P.

Definition.—The wood of *Picrasma exilis* (Swz.) Plancon, known commercially as Jamaican quassia or of *Quassia amara* L., known commercially as Surinam quassia.

Description and Properties.—In the shops it is usually met with in the form of chips or raspings of a yellowish-white color, or in billets (Surinam). Quassia contains two bitter principles—*quassin* and *picrasmin*. It contains *no tannin*.

Dose.—10–30 grains (0.6–2.0 Gm.) [$7\frac{1}{2}$ grains (0.55 Gm.), U. S. P.].

Official Preparations.

Extractum Quässisæ—Extracti Quässisæ—Extract of Quassia.—*Dose*, 1–3 grains (0.05–0.2 Gm.).

Fluidextractum Quässisæ—Fluidextracti Quässisæ—Fluidextract of Quassia.—*Dose*, 10–30 minims (0.6–2.0 Cc.) [average dose, 8 minims (0.5 Cc.), U. S. P.].

Tinctura Quässisæ—Tincturæ Quässisæ—Tincture of Quassia.—*Dose*, 30 minims (2 Cc.).

Gentiāna—Gentiānæ—Gentian. U. S. P.

Origin.—The dried rhizome and roots of *Gentiana lutea* L., a plant from 2 to 3 feet high, indigenous to the mountainous portions of Central Europe.

Description and Properties.—It appears in nearly cylindrical pieces or longitudinal slices about 1 inch (25 Mm.) thick, the upper portion closely annulate, the lower longitudinally wrinkled, externally deep yellowish brown, internally lighter, somewhat flexible and rather thick, separated from the subspungiose medulla by a black cambium line. Odor peculiar, faint, stronger when moistened, taste sweetish and persistently bitter. Gentian contains a bitter glycoside (*gentiopicroin*) and also *gentiac acid*, to which its yellow color is due. It contains about 15 per cent. of glucose, but *no starch* nor *pure tannin*.

Dose.—5–30 grains (0.3–2.0 Gm.) [15 grains (1 Gm.), U. S. P.].

Official Preparations.

Extractum Gentiānæ—Extracti Gentiānæ—Extract of Gentian.—*Dose*, 2–10 grains (0.12–0.6 Gm.) [4 grains (0.25 Gm.), U. S. P.].

Fluidextractum Gentiānæ—Fluidextracti Gentiānæ—Fluidextract of Gentian.—*Dose*, 5–30 minims (0.3–2.0 Cc.) [15 minims (1 Cc.), U. S. P.].

Tinctura Gentiānæ Composita—Tincturæ Gentiānæ Compositæ—Compound Tincture of Gentian.—*Dose*, 1–2 fluidrams (4.0–8.0 Cc.) [1 fluidram (4 Cc.), U. S. P.]. 10 per cent. with orange peel and carianum.

Calūmba—Calūmbæ—Calumbæ. U. S. P.

(COLUMBO)

Origin.—The dried root of *Jatropha palmata* (Lam.) Miess., a plant native to the forests of Eastern Africa and Madagascar, and cultivated in the East Indies.

Description and Properties.—Nearly circular disks, 1 to 2 inches (25–50

Mm (in diameter and $\frac{1}{4}$ to $\frac{1}{2}$ inch (6-12 Mm.) thick. Externally greenish-brown and wrinkled, internally white or greenish-yellow, depressed in the center, with a few interrupted circular (perforating wood) lines, distinctly radiate on the outer portion; fracture short, brittle, rather light, taste peculiar, slightly aromatic, very bitter. It contains a bitter extractive principle (calumbin, calumbic acid, berberine) and starch. *Myristicin* is present.

Dose.—10-60 grains (0.6-4.0 Gm.) [30 grains (2 Gm.), U. S. P.]

Official Preparations.

Fluidextractum Calumbæ—**Fluidextracti Calumbæ**—**Fluidextract of Calumba**.—*Dose*, 10-60 minims (0.6-4.0 Cc.) [30 minims (2 Cc.), U. S. P.]

Tinctura Calumbæ—**Tinctura Calumbæ**—**Tincture of Calumba** (20 per cent).—*Dose*, 1-4 fluidrams (4.0-15.0 Cc.) [1 fluidram (4 Cc.), U. S. P.]

Calendula—Calendulæ—Calendula. U. S. P.

(MARIGOLD)

Origin.—The dried ligulate flowers of *Calendula officinalis* L., an annual plant, a native of the Levant and Europe, frequently cultivated as a garden flower.

Description and Properties.—Flowers about $\frac{1}{2}$ inch (12 Mm.) long, leaves and strap-shaped, delicately veined longitudinally, yellow or orange colored, three-furrowed at the apex, the short, hairy tube enclosing the receptacle of the numerous comparatively small flowers. Odor slight and somewhat heavy, taste rather bitter and slightly astringent. It contains a peculiar gummy principle, *calendulin*, a bitter constituent, and a trace of volatile oil.

Dose.—5-30 grains (0.3-2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Official Preparation

Tinctura Calendulæ—**Tinctura Calendulæ**—**Tincture of Calendula** (20 per cent).—*Dose*, 15-60 minims (1.0-4.0 Cc.)

Chirata—Chiratæ—Chirata. U. S. P.

Origin.—The dried plant *Sarcocolla Chirata* (Rox.) Hamilton, an annual, native to Northern India.

Description and Properties.—Chirata, as found in the shops, consists of short sections of the stem and branches pressed and split down at the joints in color, and mixed with a few leaves and flowers. It contains a very bitter resinous principle, a hygroscopic glycoside, *chiratin*, a rather strong liquid (opium and), a resin, containing caffeine, etc. *Sarcocollin* is present.

Dose.—5-30 grains (0.3-2.0 Gm.) [15 grains (1 Gm.), U. S. P.]

Official Preparation.

Fluidextractum Chiratæ—**Fluidextracti Chiratæ**—**Fluidextract of Chirata**.—*Dose*, 5-30 minims (0.3-2.0 Cc.) [15 minims (1 Cc.), U. S. P.]

AROMATIC BITTERS.

Anthemis—Anthémidis—Anthemis. U. S. P.

(CHAMOMILE)

Origin.—The dried flowers of *Anthemis nobilis* L., a low perennial plant indigenous to Southern and Western Europe.

Description and Properties.—Heads subspherical about $\frac{1}{4}$ inch (2 Cm.) broad, composed of an inferior whorl of small tubular flowers, and a superior whorl of larger tubular flowers, and a few, of very various smaller ones, scattered among the larger, coming, when in flower, of a strong, agreeable odor and an aromatic, bitter taste.

Anthenus contains a bitter principle, a pale-brown trace of tannin, together with other unimportant

Dose.—15-60 grains (1.0-4.0 Gm.) [3 or fluidextract.

Prūnus Virginiāna—Pr Cherry.

Origin.—The bark of *Prunus serotina* autumn.

Description and Properties.—It fragments $\frac{1}{2}$ inch (2 Min.) or more thick; a brown, smooth and somewhat glossy, marked collected from the old wood and deprived of brown and uneven; inner surface somewhat water it develops a distinct bitter-almond odor. It contains tannin, resin, a glycoside—*amygdalin*. In the presence of water the glycoside a volatile oil. Benzaldehyd results also from 160° F. destroys the action of the ferment

Dose.— $\frac{1}{2}$ -1 dram (2.0-4.0 Gm.) [30 g

Official Pre

Fluidextractum Prūni Virginiānæ—F
extract of Wild Cherry.—*Dose*, 30-60 min
S. P.]

Infusum Prūni Virginiānæ—Infusi
Cherry.—*Dose*, 1-2 fluidounces, 30.0-60.0 (

Syrupus Prūni Virginiānæ—Syrupi
Cherry.—*Dose*, 2-4 fluidrams (8.0-15.0 C.)

Serpentāria—Serpentāriæ

(VIRGINIA SN

Origin.—The dried rhizome and root
Serpentaria) or *Aristolochia reticulata* Nut
indigenous in the United States.

Description and Properties.—Th
1 inch (25 Min.) long, thin, curved, on the
bases; on the lower side with numerous thin
long; dull yellowish-brown, internally whi
longest on the lower side; odor aromatic, c
camphoraceous. It contains $\frac{1}{2}$ per cent o
Lochin, tannin, resin, starch, etc. The root
longer, and less interlaced than those of *Ar*

Dose.—10-30 grains (0.6-2.0 Gm.) [15

Official Pre

Fluidextractum Serpentāriæ—Fluide
Serpentaria.—*Dose*, 10-30 minims (0.6-2.0

Tinctura Cinchōnæ Composita—Th
pound Tincture of Cinchona.—*Dose*, 1-4
serpentaria).

Tinctura Serpentāriæ—Tinctura Ser
per cent).—*Dose*, $\frac{1}{4}$ -2 fluidrams (2.0-8.0 C

Antagonists and Incompatibl
silver are incompatible with gentian
preparations of iron can be given w
Boiling water impairs the virtues o

Synergists.—The digestants, mineral acids, and, under certain conditions, alkalis, and the restorative agents generally, aid the action of vegetable bitters.

Physiological Action.—Because of their action in augmenting the secretions from the salivary and gastric glands, they aid digestion and improve nutrition.

Pure bitters act immediately upon contact; that is, their efficiency is due to their local action upon the mucous membrane of the mouth, tongue, and esophagus.

Bitters increase the secretion from the salivary glands. This effect is produced by stimulating the ends of the nerves of taste distributed in the mucous membrane of the mouth, from which nerves the impression is conveyed to the center in the medulla, and from there transmitted to the vasomotor and secretory nerves supplying the salivary glands, increasing their blood-supply and activity and at once promoting the secretion of saliva.

Bitters increase the secretion from the gastric glands. The primary action is an augmented flow of gastric juice, caused by reflex stimulation from the mouth. It is well known that there is an intimate relationship between the stomach and the senses of taste and smell. The taste of victuals or the odor of a tempting dinner excites the appetite, and, reflexly, the flow of gastric juice, similar to the flow of saliva in a dog looking wistfully at a meat-stand. Bitters act in a similar manner. The nerves of taste are stimulated, the impression is conveyed to the medulla, and from it transmitted not only to the salivary glands, but through the fibers of the vagus, increasing the blood-supply to the gastric glands and thereby promoting their functional activity.

Bitters stimulate the peristaltic movements of the stomach by reflex action. The sensory nerves in the mucous membrane are irritated, and an impression is conveyed by them to Auerbach's plexus between the muscles in the walls of the stomach, from which plexus, or ganglion, the influence is transmitted to the muscles themselves, causing increased activity or peristalsis.

Another method by which peristalsis is stimulated occurs when the impression is conveyed by the sensory nerves directly to the center in the medulla, and from there through the motor fibers of the vagus to Auerbach's plexus, affecting the muscles in the manner just described.

Bitters augment absorption by increasing the blood-supply to the mucous membrane of the stomach. It is a physiological fact that the larger the blood-supply passing through the blood-vessels, and the greater the amount of lymph conveyed through the lymph-channels, the more rapid the absorption.

Bitters also induce leukocytosis. Their action as antiseptics is secondary to the increase of the gastric juice, digestion being a physiological fermentative process, forming a contraindication to the administration of bitters during active digestion.

Therapeutics.—*Externally and Locally.*—The uncture of calen-

dula is recommended by many physicians for *contusions*, *sprains*, etc., tincture of *arnica*. The drug has *pharyngitis*.

Internally.—The simple bitters and fermentative dyspepsia, chronic in convalescence from acute diseases, *anorexia* following it.

Infusion of QUASSIA is a most *seal-worms* (*Oxyuris vermicularis*), the rectum, which has been previous water and cleared of mucus by saline.

The aromatic bitters are used to improve the condition of the digestive system, are similarly used, but the former tonic properties, owing to their volatile oils. CHAMOMILE, in addition to its action, has been employed with benefit in *menagogue*, while in the form of tincture, it serves as an efficient application for *eczema*.

WILD CHERRY might not inaptly be called peculiarly bitter, yet not unpleasant to the stomach, and rendering it tonic, especially during convalescence. Upon the heart allays febrile action, and of wild cherry is a common ingredient thought to quiet the cough and all system in *bronchitis* and *phthisis*—cyanic acid which it contains.

SERPENTARIA is considered an emetic and *capillary bronchitis*. Next to its value seems to be as a stimulant. Compound tincture of cinchona is used in the low forms of typhoid. Bitter and pleasant bitter. Cinchona and nuxvomica bitters.

Contraindications.—Bitters should not be given when the secretion of gastric juice is diminished in disease. They are contraindicated in the course of acute disease, as in *fever*, for at this time they fail to improve the appetite. In convalescence from acute diseases, they are contraindicated. They are also contraindicated in the depressed and hypochondriacal states, and in a variety of sources, and in which they are contraindicated.

Administration.—To improve the appetite, given from one-half to one hour before meals. If used for a long time, one should not use them in the course of every week.

may rebel at the monotony. Bitters may be given in the form of a powder or a solid extract. Ordinarily, however, it is preferable to administer a liquid preparation—fluidextract, tincture, or infusion. A pleasant method of giving the latter preparation in the case of quassia is to allow water to stand overnight or for a few hours in a quassia-cup—purchasable at almost any drug store—when the water will become impregnated with the bitter principle of the quassia.

DIGESTANTS.

Pepsinum - Pepsini—Pepsin. U. S. P.

Origin.—A proteolytic ferment or enzyme obtained from the glandular layer of fresh stomachs of the hog (*Sus scrofa*), the capacity of digesting and dissolving gelatin in its own weight of freshly coagulated and thoroughly stirred egg albumin when tested by the process given in the United States Pharmacopoeia.

Description and Properties.—A fine white, or yellowish-white, amorphous powder, or thin pale yellow or castor-oil like extract or tincture, granular in mass, free from offensive odor, and having a mucous consistency or slightly sticky taste, usually followed by a suggestion of bitterness. It is not attracted by water when exposed to the air. Soluble in for the most part soluble in a small amount of water with more or less insolubleness, more soluble in water and alcohol with $\frac{1}{2}$ volume of water or in alcohol, ether, or chloroform. Pepsin usually has a slightly acid reaction. It may be neutralized but does not lose its activity.

Dose.—5-20 grains (0.3-40 gm.) [4 grains (0.25 gm.) U. S. P.]

Antagonists and Incompatibles.—Tannic and gallic acids are incompatibles. Mineral salts, alcohol more than 10 per cent, and alkalis precipitate pepsin from solution, the latter two impairing its digestive property.

Synergists.—Diluted hydrochloric acid, in not over $\frac{1}{2}$ of 1 per cent, increases its digestive action.

Physiological Action.—Its only influence seems to be upon the digestive system. Pepsin is a typical restorative, being a normal constituent of the gastric juice, and in the presence of hydrochloric acid digesting the proteid elements of the food, converting them into albumoses, and finally into peptones.

Therapeutics.—*Internally and Locally.*—Its digestive action is utilized to dissolve or digest the false membrane in *diphtheria* and *croup*. A solution of pepsin has also been injected into the bladder to digest blood clots.

Internally.—As a restorative, where there is a lessened secretion of gastric juice, *atony dyspepsia*, *apexia* of infants, *anorexia*, *fermentation*, and *gastric ulcer*, pepsin has proved serviceable. It is also employed to hasten digestion in convalescence from acute and long illness. It is frequently necessary to give pepsin or peptonized milk in acute *dyspepsia*, *diarrhea* of infants.

Administration.—Pepsin should be given in powder or dissolved in glycerin (glycerol of pepsin), or in water acidulated with hydrochloric acid directly after meals.

The drug should not be given continuously for a long period, lest the function of the stomach become in

disuse, the artificial digestion having process.

Unless there be some direct indication to give pepsin it is better to stimulate the larger amount of their normal juice and their function be consequently secured. Hydrochloric acid administered with pepsin increases activity slightly. Often, however, in certain patients the stomach is in such a state that emetics must be administered. Yet, in feeble powers of digestion, foods such as peptonized meat are frequently

Pancreatinum—Pancreaticum

Origin.—A mixture of the enzymes of the pancreas of blooded animals, usually obtained from the pancreas, consisting principally of amylase, trypsin, and lipase, converting not less than 25 times its own weight in water.

Description and Properties.—A white, amorphous powder, odorless, or having a faint, somewhat meat-like taste. Slowly and almost insoluble in alcohol.

Pancreatin digests albuminoids and all sugars, and, when not over twenty-four hours in prolonged contact with mineral acids renders it digestible.

Dose.—10–20 grains (0.6–1.2 Gm.) [7]

Antagonists and Incompatibles.

Synergists.—Weak alkalis.

Physiological Action.—The function of the pancreas is to render it capable, in either weak or strong acid conditions, of digesting proteid foods, emulsifying fat into fatty acids and glycerin, coagulating and curdling milk.

Therapeutics.—Like pepsin, it is used in the treatment of certain disorders of digestion.

Administration.—It may be given in compressed pills, or in solution. It is best given in combination with an alkali, as it is destroyed by acids, and should be given one or two hours after meals, when the chyme is not yet acid. It may also be administered immediately after meals, since there is an interval of from ten to fifteen minutes after the ingestion of food before the gastric juice is rendered sufficiently acid by the gastric juice. The activity of the pancreatin.

For rectal nourishment pancreaticum is used in the form of a suppository.

Pankreon is a recently introduced preparation of the enzymes.

Papain, Papoid, or Papayotin. (Non-official.)

Origin.—The expressed juice of the unripe fruit of *Carica Papaya*.

Description and Properties.—A whitish, slightly astringent powder, soluble in water.

Dose.—1-3 grains (0.06-0.5 Gm.).

Antagonists and Incompatibles.—Tannic and gallic acids. Lead salts and alcohol are incompatible with papain.

Synergists.—The digestive ferments.

Physiological Action.—In this it resembles pepsin, though differing from the latter, as well as from pancreatin, in that it is equally active in neutral, alkaline, or acid media. It converts proteids into soluble peptones, and acts as a stimulant to the gastric glands. It converts starch into maltose, and upon false membranes acts more energetically than pepsin. It may dissolve intestinal

Therapeutics.—*Externally.*—The uses of papain are more manifold than those of the digestive ferments previously mentioned. Like pepsin, it has been successfully employed to dissolve false membrane in *diphtheria* and *croup*. The juice of pineapple, which possesses a ferment (bromelin) similar to that of papain, is a valuable domestic remedy in these diseases. Papain has been used with some benefit in *indurated eczema* and in *symphilitic ulcerations of the tongue*. It has been highly recommended by Johnston as a *solvent of cerumen*: 15 drops (1 Cc) of a solution of 20 grains to 1 ounce (1.2 Gm to 30 Cc) of distilled water are dropped into the outer meatus, and the parts syringed an hour afterward with a solution of boric acid.

Internally, papain may be used for the same purposes as pepsin and pancreatin, yet, while hypothetically superior, it is practically inferior to them, fortunately not having supplanted them in actual practice.

Administration.—When used to aid digestion, papain should be given after meals, either in powders, capsules, compressed tablets, or aqueous solution, freshly prepared.

Amylolytic Enzymes.

In the germination of many seeds the starches contained therein are converted by enzymes into soluble starch or sugars, and thus nourish the young plant. Many bacteria are capable of breaking down starches, as well as proteids, and some moulds develop amylolytic, as well as proteolytic, enzymes of marked activity.

Of late years much use has been made of a number of these enzymes. That from grain—barley, malt—containing the enzyme *diastase* has been widely used, especially in proprietary medicines.

Maltum—Malti—Malt. U. S. P.

Definition.—The grain of barley, *Hordeum distichum* L., partially germinated artificially and then dried.

Extractum Malti—Extractum Malt.

This and Maltum are reintroductions in to the 1880 revision but dismissed in 1890.

Description and Properties.—Malt contains carbohydrates—maltose and dextrin—and contains the phosphates of calcium and magnesium (by which the diastase would be destroyed). In the U. S. Pharmacopœia process, the preparation is an efficient ferment for the conversion of starch into sugar, but it rapidly deteriorates on keeping.

Dose.—Average dose: 4 fluidrams (16

Diastase prepared from malt (135° F.) is capable, in neutral or weak acid solutions, of digesting appreciable quantities of starch; however, if this action will take place to a considerable extent, and still more doubtful if it has been termed starchy indigestion. Malt compounds are of any service to the efficiency of such compounds.

One amylolytic ferment from (Ahlburg), which has been utilized for centuries, particularly in the production of Sake, has been introduced with therapeutics under the name of *talb*. It is quite doubtful if it has any power to digest starch found in the intestines after any length of time. Excellent results, and it is deserving of trial, the action of foreign ferments it is largely foreign proteid bodies are digested as such, apart from their enzymes of the digestive tract, not

FATS AND OILS

Öleum Mörrhuæ—Ölei Mörre.

Origin.—A fixed oil obtained from the other species of *codrus*.

Description and Properties. A peculiar, slightly fishy, but not rancid odor, a gravity 0.918 to 0.922 at 25° C. (77° F.). Soluble in ether, chloroform, or carbon disulphide. Contains glycerates of stearin and palmitin, triglycerides, phosphoric and sulphuric acids, and decomposition products. The most important principles of cod liver oil, occurs as mone, hexylamine, amylamine, asceline, and active principle exists in this oil.

MÖRRHUOL, a name given by Chapteaut important principles of cod liver oil, occurs as

Dose.—1-4 fluidrams (3.8-15.0 Cc.) [4

**Emûlsûm Ôlei Môrrhuæ—Emûlsi Ôlei Môrrhuæ—
Emulsion of Cod-liver Oil. U. S. P.**

A standardizing preparation, containing 40 per cent of cod-liver oil. It may be flavoured to suit the taste, with oil of glycerine, oil of sweet almond, etc.

Dose.—Average dose, 2 fluidrams (N. E., U. S. P.)

**Emûlsûm Ôlei Môrrhuæ cum Hypophosphitibus—
Emûlsi Ôlei Môrrhuæ cum Hypophosphiti-
bus—Emulsion of Cod-liver Oil with Hypo-
phosphites. U. S. P.**

Similar to *emûlsûm môrrhuæ*, but containing the hypophosphites of calcium, potassium, and sodium.

Dose.—Average dose, 2 fluidrams (N. E., U. S. P.)

Physiological Action.—*Externally and Locally.*—It possesses emollient properties, and may be applied to the skin and mucous membranes without causing irritation. It slightly reduces temperature in fever when applied to the body.

Internally.—Fat is a normal and necessary constituent of the body. It is the fuel used to supply energy, and those tissues and organs which are the most active require the most fat. Consequently, nerves, muscles, and glands are more abundantly furnished with fat than cartilage, and in cases of starvation these structures demanding the greater supply must have it, at the expense of the less highly organized and active tissues—as is seen in the great emaciation preceding the decline of mental powers. The blood contains about one-half of 1 per cent of fat, the muscles, 3 per cent, the brain, 8 per cent, and the nerves, 22 per cent. In order, therefore, that the various cells of the body may possess sufficient vitality to withstand by physiological resistance the encroachments of disease and the invasion of pathogenic micro-organisms, this equilibrium must be maintained. Yet this necessary food, fat, is more frequently deficient than any other, it is the difficulty either of obtaining a supply or of digesting and assimilating it.

Before oils or fats can enter the various cells and act as food, and consequently be a source of power, they must be digested and assimilated by the body. The value of an oil is based upon: (1) its rate of absorption, (2) its rate of oxidation, (3) its agreeable taste.

Cod-liver oil, while to many persons repugnant in taste, is more readily absorbed and oxidized than any other fat. It has already been prepared by the liver, and is hence partly elaborated and, owing to the bilary salts which it contains, it passes more readily through animal membranes. Moreover, N. S. Martin has shown that cod-liver oil is more easily oxidized than any other oil, rendering this substance almost an ideal ready-made food. Its actions upon the several systems are here considered.

Digestive System.—Large doses disturb the stomach and may

even occasion vomiting, but in the form of an emulsion, it may be taken in some cases even increasing the liver oil is unaffected, but in the juice, which resolves a portion of the latter combining with the alkaline juice to form soaps, while the oil is emulsionized by the alkaline

Circulatory System.—The number and the quality of the blood is greatly improved.

Nervous System.—This shares in the body, the general amelioration, the brain and nerves.

Respiratory System.—No special benefit, the natural improvement in the blood and an increased function of the muscles.

Absorption and Elimination.—Cod-liver oil after it enters the intestines. The action is aided by the pancreatic and the intestinal juices produced by the action of the bile on the mucous membrane.

The oil remaining, as has been shown, it is subdivided into minute globules composed of alkaline albuminate of calcium, having an affinity for the mucous membrane of the columnar epithelium of the intestine. The osmosis inward of the oil-emulsion is aided by the action of the bile with which it is mixed.

It will be seen that much of the oil is oxidized, being subsequently excreted in the urine.

Temperature.—When taken in large quantities, it is sometimes febrile, but, as has been observed, the bodily heat is reduced.

Outward Action.—In addition to the internal action, it sometimes occasions by moderate doses a vesicular eczema which is confined to the body. This eruption is probably due to the action of the oil on the skin which the oil contains. At times it produces a dryness of the skin.

Poisoning.—Cod-liver oil possesses no special poisonous properties.

Therapeutics.—*Externally* and *internally* used by dermatologists in diseases of the skin, it is valuable in softening the crusts of the skin to allay irritation and for the exanthemata.

Daily inunctions are beneficial in the treatment of the skin, while a local application to the chest is favorable to the course of pertussis.

Internally.—For two or three

used both externally and internally for *chronic rheumatism*, but it is only since 1841 that it has been employed in the treatment of *tuberculosis*. While to-day it does not receive the enthusiastic support which attended its introduction in the latter disease, it is nevertheless a standard and highly efficacious remedy in the various forms of the disorder. It is equally valuable in *wetulous affections*, and even more potent in *rachitis*. *Chronic bronchitis* is perhaps more frequently relieved by its use than by any other internal remedy. Diseases resulting in *anemia* are usually more benefited by cod-liver oil than by other remedial agents. *Chronic arthritis*, *fistula* and *abscess* in the neighborhood of the joints, have been greatly improved by its use. *Atheroma of the arteries* and many *cutaneous diseases*, particularly the *strumous* variety, and *syphiodermata* yield to its alterative and nutrient properties.

Probably no single drug is employed in *nervous diseases* with effects so markedly beneficial as those of cod-liver oil. While possessing no specific action, it increases the strength and vitality of the patient, enabling him to resist morbid tendencies more successfully, and, by improving the condition of the nerves, lessens the liability to nervous derangement.

Diabetes mellitus and *Bright's disease*, with anemia yet unattended by marked digestive disturbance, are decidedly improved by the administration of cod-liver oil.

Should no gastric disorder supervene, this remedy should invariably be given in the last-named diseases. It certainly serves to maintain the general health, and is singularly efficacious in prolonging the lives of the afflicted patients, enabling them to profit by hygienic measures, upon which great reliance should be placed. The tonic and nutritive properties of the drug have been strikingly shown in the rapid improvement of patients *convalescing* from *acute diseases*. In *catarrhal conditions*, especially in *ozena* and *stasis* following measles and scarlet fever, it is of marked benefit.

Without entering upon specific considerations other than the above, it will be seen that cod liver oil is indicated whenever there is defective activity, whether inherited or acquired.

Contraindications.—It is to be remembered that cod liver oil is a food and not a medicine. It is therefore contraindicated in all diseases where it proves detrimental to the appetite, causing eructation, heartburn, diarrhea etc. It is usually contraindicated in fevers, owing to the suspension of the secretions and impairment of digestion characteristic of acute febrile disorders.

Administration.—In the early use of cod-liver oil it is advisable to prescribe small doses, that its toleration by the stomach may be gradually acquired. To many patients, however it is extremely distasteful, and the repugnance is increased rather than lessened by continued use. In such cases it is better, if possible, to disguise the taste and smell in some manner rather than to abandon so valuable a remedy when clearly indicated. Various means have been employed for this purpose. An emulsion may

be made which obviates its disagreeable qualities. There are in the market soft capsules containing this oil that serve an excellent purpose, being easily swallowed and disguising completely the taste and odor of the drug. Administration should occur ordinarily some time after meals, that the oil may reach the intestines as soon as possible.

EMETICS.

Emetics are agents which produce vomiting or *emesis*.

Emesis is, in short, an antiperistaltic action, complex in its mechanism. Emetics are largely out of fashion in medicine at the present time, but are in so much demand when needed, particularly in poisoning, that their consideration is worthy of separate treatment.

The local or gastric emetics¹ are :

- | | |
|---------------------|------------------------------|
| * Alum ; | * Yellow mercuric sulphate ; |
| * Copper sulphate ; | * Sodium chloride ; |
| * Zinc sulphate ; | * Ammonium carbonate ; |
| * Mustard. | |

Apomorphine hydrochloride, antimony and potassium tartrate, ipecacuanha, and lobelia are thought to be medullary emetics.

Local or gastric emetics are the more rapid in their action, producing emesis in from two to five minutes. The systemic emetics must be absorbed and pass to the medulla before they produce vomiting, consequently requiring more time to exert their influence. Moreover, the action of the latter class of emetics is of much longer duration and followed by greater depression of the muscular and circulatory systems, together with greater constitutional disturbance.

Some emetics act both locally and centrally. Tartar emetic and ipecacuanha affect the stomach locally, and it has recently been called in question whether their medullary action is even present, not to say important. Zinc sulphate and copper sulphate, while to a slight extent acting on the medulla, are classed as local emetics, because their principal action is upon the mucous membrane of the stomach.

Within a few minutes after an emetic has been ingested there is a feeling of nausea and distress, with decided muscular relaxation. The circulatory system is depressed ; the pulse is small and irregular, and a sensation of faintness ensues. The flow of saliva is increased, and vomiting soon follows. During emesis the arterial tension is raised, the face is flushed, and there is an increase in bodily heat. When vomiting has subsided there is a reduction of temperature, with cardiac and muscular weakness, the skin being bathed in perspiration. Occasionally fatal syncope has followed the use of emetics.

¹ (The drugs marked with an asterisk (*) are considered elsewhere in the present work.)

Antagonists.—Drugs known as Antiemetics are used to allay nausea and check vomiting. Like emetics, these agents are divided into Local Antiemetics or Gastric Sedatives and Direct or Systemic Antiemetics, according to their action.

Among the most important Antiemetics are the following :

Local Antiemetics or Gastric Sedatives.

(All of these are discussed elsewhere in the present work.)

Alcohol (especially champagne);	Ether;
Arsenic (small doses),	Ipecac (small doses);
Belladonna,	Ice.
Bismuth subnitrate and subcarbonate,	Opium,
Carbolic acid,	Hydrocyanic acid;
Cerium oxalate;	Menthol;
Chloroform,	Potassium nitrate;
Cocaine,	Silver nitrate,
Creasote;	Sulphocarbonates,
Calomel (small doses);	Tincture of iodine (small doses).

Direct or Systemic Antiemetics or Gastric Sedatives.

Alcohol;	Chloral.
Ammonium;	Hydrocyanic acid;
Amyl nitrite	Nitroglycerin,
Bromides,	Opium.

It will be observed that some drugs are both local and direct antiemetics.

There are certain measures which may be adopted to allay nausea and relieve vomiting, such as a recumbent posture and injection of large quantities of aerated water into the rectum.

Synergists.—The emetics are, of course, mutually synergistic. Emetics are adjuncts to antispasmodics and expectorants although the latter do not particularly enhance the action of the former.

Emetic are used:

1. *To empty the stomach* in cases where the presence of undigested food occasions pain, headache, etc., or to expel some poisonous substance from the stomach. For this purpose the local emetics are preferable.

In cases of poisoning the local emetics are the more reliable.

2. *To remove foreign bodies from the oesophagus.* For this purpose the direct or systemic emetics should be used.

3. *To remove foreign bodies from the larynx,* as in cases of membranous croup, laryngeal diphtheria, etc. the effort of vomiting being sometimes sufficient to dislodge and remove the membrane or other foreign substance.

4. *To remove the tracheal secretion* in cases of bronchitis and catarrhal pneumonia. In these cases the direct emetics should be

employed, preferably ipecacuanha (which possesses more expectorant properties).

5. *To empty the gall-bladder* in cases of cholecystitis or where small gall-stones are present. This is accomplished by compression of the liver between the thumb and fingers, the muscles expelling the bile from the gall-bladder, thus forcing the gall-stones through the cystic duct.

6. *To relax spasm of the pharynx* in cases of acute pharyngitis or laryngitis. For this purpose it is very valuable.

Contraindications.—Emetics are contraindicated in cases of poisoning, suffering from aneurysm, hernia, peritonitis, or rectum, atheroma, or where there is a tendency to hemorrhage from the lungs, or after abortion.

The emetic drugs which have been used in the present work are here given in detail.

Apomorphinæ Hydrochloridum Hydrochlōridi—Apomorphine U. S. P.

Origin.—The hydrochloride of an alkaloid obtained by abstraction of one molecule of water from morphine.

Description and Properties.—Microscopic crystals, without odor, having a faintly bitter taste. Exposure to light and air. Soluble in about 1 part of alcohol. It should be kept in small, dark glass bottles. It imparts to 200 parts of water when slightly shaken.

Dose.— $\frac{1}{10}$ – $\frac{1}{8}$ grain (0.003–0.006 Gm.) by mouth; 1 Gm.) hypodermically ($\frac{1}{10}$ grain as expectorant (0.005 Gm.), U. S. P.).

Physiological Action.—External.

Internally.—Digestive System.

after ingestion—according to the dose administered—vomiting ensues, being repeated at intervals of about fifteen minutes. This is attended by a slight nausea, with burning in the stomach. Apomorphine is a typical direct or sympathetic emetic, being exerted upon the medulla. It has a certain emetic we possess. So far as its action is concerned, its relation to morphine should be noted.

Nervous System.—Full doses still occasion delirium. Apomorphine has been used as a hypnotic and may be used as a hypnotic. It has been observed when given in large doses.

Circulatory System.—Small doses increase the circulation. Full doses increase the heart's action and raise arterial pressure.

accelerator nerves and vasomotor center. Large or toxic amounts depress the circulatory system or paralyze the cardiac muscle.

Respiratory System.—Small amounts do not affect the respiratory movements, although the secretion from the bronchial mucous membrane is increased. Full doses accelerate and deepen respiration, while toxic amounts cause depression, as does morphine.

Absorption and Elimination.—Apomorphine is readily absorbed, and is excreted through the gastro-intestinal tract, as well as by the bronchopulmonary mucous membrane, the kidneys, and the skin.

Temperature is unaffected by small doses, but may be lowered by large amounts.

Poisoning.—The symptoms would be violent vomiting, delirium, or convulsions, and marked cardiac and respiratory depression, death resulting from asphyxia.

Treatment of Poisoning.—As that of morphine-poisoning.

Therapeutics.—Apomorphine is the most reliable emetic to use when prompt emesis is necessary or in cases where swallowing is difficult or impossible.

It is extremely useful as an emetic in cases of poisoning, though it frequently happens in narcotic poisoning that the vagus center is so blunted by the poison that apomorphine fails to act. Should it be necessary to provoke emesis when the stomach is in a state of acute inflammation, apomorphine is preferable to any other emetic.

Given by the mouth in small doses—from $\frac{1}{16}$ grain (0.001 Gm.) to $\frac{1}{8}$ grain (0.003 Gm.) every three or four hours—this drug is an exceedingly efficient remedy in *acute bronchitis*. It is equally beneficial in relieving the dry, hacking cough of *chronic bronchitis*, *chronic catarrhal pneumonia*, and *tuberculosis*.

Apomorphine in small doses has often proved a serviceable hypnotic.

Contraindications.—The same as for emetics generally. It is contraindicated in morphine-poisoning.

Administration.—Apomorphine when given as an emetic should invariably be administered hypodermically, and the solution be always freshly prepared. When the drug is used as an expectorant it should be given by the mouth. Great care should be taken in administering the drug to children, as they bear it badly.

Antimōnii et Potassii Tartras—Antimōnii et Potassii Tartrātus—Antimony and Potassium Tartrate. U. S. P.

(TARTAR EMETIC, TARTARATED ANTIMONY.)

Origin.—Antimony trioxide is mixed with acid potassium tartrate and water in the presence of a paste, allowed to stand for twenty-four hours, boiled in water and crystallized.

Description and Properties.—Colorless, transparent crystals of the rhombic system, becoming gray and white on exposure to air, and white granular powder on trituration and having a sweet, afterward disagreeable, taste. Soluble in 15 parts of water and in 3 parts of boiling water; but insoluble in alcohol, which precipitates it from its aqueous solution in the form of a crystalline powder.

Dose.—1-2 grains (0.06-0.12 Gm.) as a cardiac depressant, $\frac{1}{2}$ grain (0.005 Gm.) as an expectorant, $\frac{1}{10}$ grain (0.005 Gm.) as an expectorant, $\frac{1}{10}$

Official Prep

Syrupus Scillæ Compositus—Syrupus of Squills (Hive Syrup).—Kenna's Preparation, 80; antimony and potassium tartrate, to 1000.

Dose.—5-60 minims (0.3-4.0 Cc.)

Vinum Antimonii—Vini Antimonii.—Antimony and potassium tartrate, 4, boiling distill to 1000.

Dose.—5-60 minims (0.3-4.0 Cc.) [15 m

Antagonists and Incompatibles.—Cardiac stimulants and antispasmodics. Tannic and gallic acids and the lead.

Synergists.—Emetics, cathartics potentiate the action of tartar emetic.

Physiological Action.—*Externally.*—Is a powerful irritant when applied to the skin, causing inflammation followed by a pustular eruption, and later forming pustules with suppuration. Finally occurring, the pustules become small-pox. Necrosis and ulceration.

Internally.—**Digestive System.**—The gastro-intestinal tract, as upon the stomach, potassium tartrate acts as a powerful irritant, causing only a sensation of warmth in the stomach, increased secretion of saliva and gastric juice from the intestines, liver, and pancreas, frequently accompanying these symptoms.

A little larger dosage excites vomiting. After absorption, it is thought that the drug acts on the medulla, causing vomiting, but not on the medulla. Full or large doses irritate the intestines, causing watery discharges, if the dose has been small. Severe cramps and epigastric distress are going symptoms.

Circulatory System.—Tartar emetic acts as a cardiac depressant, even in small doses slowing the heart action, and simultaneously lowering the tension of the heart muscle.

Poisonous doses of the drug cause death, which is finally arrested in diastole.

Nervous System.—Antimony acts on the brain, and under certain conditions causes delirium. Indeed, its action is th

nervous system, particularly the spinal cord, small doses depressing the sensory side, while poisonous doses depress both the motor and sensory centers of the cord. The intense prostration is probably a result of the circulatory depression acting on the nerve centers rather than a direct nerve-cell involvement.

Under the administration of antimony, therefore, reflex excitability is diminished and the muscular system is depressed, the drug acting as an antispasmodic, probably by its influence both upon the muscles and the nervous system.

Respiratory System.—Very small doses have no effect upon the respiratory movements, but increase the secretions from the bronchial mucous membrane. Full doses depress the respiratory movements shortening the inspiration but prolonging expiration. Toxic doses render the breathing extremely irregular and greatly lengthen the pause between inspiration and expiration, while there is an enormous increase in the bronchial secretion.

Absorption and Elimination.—Tartar emetic rapidly enters the blood, and is eliminated by many channels, principally by the bowels, but also by the bile, milk, sweat, and urine. The drug is an active diaphoretic, expectorant, and cholagogue.

Temperature.—Small doses do not affect temperature perceptibly, large doses lower bodily heat, chiefly by depressing the circulation.

Untoward Action.—The untoward manifestations produced by medicinal amounts of tartar emetic in individuals having a marked susceptibility to the drug do not differ essentially from the symptoms of poisoning next described.

Poisoning.—Tartar emetic produces all the symptoms of an irritant poison—severe burning sensation in the esophagus and stomach and violent and repeated vomiting, the ejecta, in addition to undigested food, containing mucus, bile, and frequently blood.

These symptoms are attended with severe colicky pains in the abdomen and serous purging, the discharges resembling those of cholera, the analogy with the latter disease being rendered the more striking by the presence of cramps in the extremities—a characteristic feature of poisoning by tartar emetic.

Together with these gastro-intestinal symptoms there is extreme prostration, accompanied by an irregular, weak, almost imperceptible pulse, great muscular relaxation, depressed respiration, pinched and livid countenance, cold, clammy skin, reduction of temperature, and scanty and bloody urine. Death may be preceded by stupor, wild delirium, or convulsions. Fatal dose of tartar emetic has been 2 grains (0.1 Gm.)—although much larger quantities have been taken. The prompt emesis has served to prevent poisoning.

Treatment of Poisoning.—If the poison has not been entirely ejected in the act of vomiting, the stomach should be immediately washed out with a solution of tannic acid after which strong coffee should be administered, together with demulcent drinks, anodynes, and respiratory and cardiac stimulants should they be necessary.

Therapeutics.—*Externally and* formerly used as a rubefacient, being of little extent. The tendency of the drug, to produce a papular eruption and destruction of the skin, is unsafe. Hebra considers that the use of it is a "useless, injurious procedure, as to life."

Internally.—The medical uses of it are becoming more restricted. Because of its action the employment of the drug has been practically abandoned. It is still used in the treatment of *inflammations*. It is beneficial in the treatment of *bronchitis*, but its administration interferes with free secretion of bronchial mucus is

The remedy is given by many in the treatment of acute lobar pneumonia.

The COMPOUND SYRUP OF SQUILL is a popular and efficient remedy for spasmodic laryngitis.

Administration.—As an emetic it is potentiated and enhanced by associating it with other drugs, together being given in powdered form.

As a diaphoretic and expectorant, antimony are preferable, repeated

Ipecacuãnhã—Ipecacuãna

Definition.—The dried root, to which is not more than 7 cm in length, of *Cephaelis* known commercially as Rio, Brazilian, or Peru, of *C. acuminata* Karst, known commercially as Peruvian, containing not more than 2 per cent of ipecac alkaloids.

Description and Properties.—The root is of 2 to 6 inches (5-15 cm.) in length and is contorted, dull grayish brown or blackish, annulated and often transversely fissured; broken from the thin, whitish, tough, ligneous part, the taste is bitterish, acrid, nauseating. When ipecac quality is proportionate to the thickness of the portion.

Carthagenia ipecac is similar to Rio and is

The active principles of ipecac are *emetin* and *emetina*; there is present 1 to 2 per cent. The drug contains also acid, starch, resin, etc.

Dose—As an emetic, 15-30 grains (1.0-2.0 Gm.).

Official Preparation

Fluidextractum Ipecacuãnhæ—Fluïdum of Ipecacuãnhæ.

Dose—As an emetic, 15-30 minims (0.2-0.5 Cc.) [as an emetic, 15 minims (1 Cc.) U. S. P.].

Pulvis Ipecacuanhæ et Opii—*Pulvis Ipecacuanhæ et Opii* Powder of Ipecac and Opium See Chapter

Syrupus Ipecacuanhæ—*Syrupus Ipecacuanhæ* Syrup of Ipecac Formula
Extract of ipecac, 70, *acetic acid* 10, *glycerin* 100, *sugar*, 700, *water*, 10
1000

Dose.—As an emetic, 2 to 5 minims; 7 to 12 to 15 cc. as an expectorant, 5 to 10 minims; 10 to 15 cc. as an expectorant; 15 minims to 1 cc. as an emetic, 4 times a day. U. S. P.

Tinctura Ipecacuanhæ et Opii—*Tinctura Ipecacuanhæ et Opii* Tincture of Ipecac and Opium See Chapter

Vinum Ipecacuanhæ—*Vinum Ipecacuanhæ* Wine of Ipecac (1 per cent) —
Dose.—1 to 20 minims; 5 to 40 cc. (15 minims to 1 cc.) U. S. P.]

Antagonists and Incompatibles.—The gastric sedatives and narcotics generally hinder the emetic properties of ipecac. The incompatibles are tannic acid and vegetable infusions containing it, metallic salts, and caustic alkalis.

Synergists.—The emetics, sedative expectorants, warm drinks, are synergistic, and opium aids the diaphoretic properties of the drug.

Physiological Action.—*Externally and Locally*.—Ipecac is a powerful irritant to the mucous membranes of the respiratory tract when the powdered drug is inhaled. The prolonged application of ipecac to the skin occasions much irritation, even producing vesication, pustulation, and ulceration. Ipecac also possesses some antiseptic properties.

Internally—Digestive System.—In small doses ipecac acts as a stimulant to the stomach. The salivary and gastric glands are stimulated, the action of very small doses of the drug resembling that of vegetable bitters.

Large doses are powerfully irritant and emetic, the emesis being the result of both a local irritation upon the stomach and perhaps some slight action on the vomiting center. The vomiting is preceded by and attended with but little, if any, nausea, although there is usually a marked increase in the secretion of bile and intestinal mucus, full doses of the drug acting not only as an emetic, but as a purgative and cholagogue.

Circulatory System.—Except in occasioning the ordinary depression incident to the act of vomiting, ipecac in moderate amounts has no influence upon the heart. Enormous doses, however, particularly if injected into the jugular vein, have destroyed the life of dogs by cardiac paralysis.

Nervous System.—Save in slight stimulation of the medulla oblongata and a slight diminution of the reflex activity of the spinal cord, ipecac has no important action upon the nervous system.

Respiratory System.—So far as the respiratory movements are concerned, they are unaffected by moderate doses of ipecac. The bronchial mucous membrane is stimulated, augmenting the secretion of bronchial mucus, and therefore reflexly stimulating coughing.

Absorption and Elimination.—The active principles of ipecac are rapidly absorbed, being eliminated chiefly by the gastrointestinal

mucous membrane, although the excretory process, the skin being which acts as a mild diaphoretic.

Temperature.—Under medicinal changed. Poisonous doses reduce

Cutaneous Action.—Rarely, in the drug, intense cutaneous irritation accompanied by neuralgia of the face. Even soiling the hand with a few drops occasioned unfavorable results.

Poisoning.—There is violent vomiting containing bile and frequently bloody stools are abdominal pain, marked weakness, and greatly diminished cold and bathed in perspiration.

Treatment of Poisoning.—Tannic chemical antidote. Opium, belladonna be necessary.

Therapeutics.—Externally and spray inhalations of WINE OF IP and expectoration in acute bronchitis

Internally.—IPECAC in proper dose and is frequently employed as suitable through the act of vomiting in *spasmodic laryngitis, bronchitis, tracheitis, diphtheria*. The action of the drug is not the most desirable emetic to use the stomach quickly, as in cases of

When the stomach contains causing pain, headache, etc., ipecac drug occasions little marked nausea

Minute doses of IPECAC, such of the WINE or $\frac{1}{16}$ to $\frac{1}{8}$ gram (or DRUG, act as an efficient gastric secretum arresting vomiting when other drugs however, that minute doses of the and vomiting of pregnancy is prolonged

IPECAC in small doses is an emetic gogue to relieve the distress of equally advantageous in *atonic dyspepsia* depression of spirits, etc.

The notoriety and pecuniary price in connection with ipecac—or *Radiatum*—is usually named by its propagator—its action in *dysentery*.

The drug is peculiarly efficient in the form of dysenteric attack may be earlier it is administered.

The drug, in order to exert a

dysentery, must be given in large doses—60 to 90 grains (3.88–5.83 Gm) in a single dose, or 20 grains (1.29 Gm) every four hours. These doses, of course, will at first produce emesis, but the repetition of them tends to establish a tolerance of the remedy, an early attainment of which is most desirable.

Various methods have been employed to aid the stomach in retaining the drug, such as the administration of opium or other gastric sedative, a sinapism placed upon the epigastrium, etc.

Ipecac has been highly recommended in *infantile diarrhea*. It has been successfully employed in *hematemesis* and *uterine hemorrhage*, it being customary in the former complaint to give at first an emetic dose, succeeded by smaller and nauseating amounts.

Like other emetics, ipecac has proved efficient in expediting labor by relieving *rigidity of the os uteri*.

The drug has been found beneficial in relieving *hemoptysis*, and it is of unquestioned value in many affections of the lungs and bronchial tubes. In *pneumonia*, particularly in the congestive and declining stages of the disease, it has proved serviceable.

In *bronchitis* and *phthisis*, especially when the secretion is scanty, and in *chronic bronchitis* with much cough and but a moderate amount of expectoration, ipecac is a valuable remedy. It has been found valuable in *spasmodic asthma*.

Ipecac is an important adjuvant to quinine in the treatment of *remittent* and *intermittent fevers*, the latter disease having been cured, it is claimed, by ipecac alone in doses of 1 or 2 grains (0.06–0.12 Gm), given every three or four hours.

Contraindications.—Ipecac is not permissible for patients suffering from aneurism, hernia, prolapse of uterus or rectum, etc.

Administration.—The drug is notoriously uncertain in its action, probably because of the variation in the percentage of emetine, the freshly powdered root being ordinarily more reliable.

As a diaphoretic the powder is also preferable, though in any case the fluidextract may be substituted for the powdered form. As an expectorant the syrup and wine are the preparations usually employed.

Children are very tolerant of ipecac, the syrup being the preparation usually given to them.

Emetine represents the crude drug fully, and may be administered as an emetic in doses of $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.005–0.01 Gm) and in correspondingly small doses when a diaphoretic or expectorant action is desired. It has been found extremely difficult to prepare it free from other substances.

Lobelia—Lobeliae—Lobelia. F. & P.

(LOBELIA TOBAC.)

Origin.—The dried leaves and tops of *Lobelia inflata* L. collected after a portion of the capsules have become dried. The plant is very poisonous in all its stages.

Description and Properties.—A weakly narcotic, whose active

of fragments of green leaves, stems, rather e
membranous capsules. The odor is very irr
ently acrid. The plant contains a yellow
lobelin acid, lobelinin, resin, fixed oil, gum.

Dose.—1-10 grains (0.05-0.6 Gm.) [

Official Pre

Fluidextractum Lobeliae.—**Fluidextr**
—*Dose*, 1-10 minims (0.05-0.6 Cc.) [8 min

Tinctura Lobeliae.—**Tinctura Lobell**
Dose, 8-15 minims (0.5-1.0 Cc.) [15 minims
as emetic, U. S. P.].

Antagonists and Incompatibl
circulatory system are antagonized
incompatibles are all caustic alkali

Synergists.—The motor depo
effect of lobelia.

Physiological Action.—*Extern*
drug is readily absorbed through
importance.

Internally.—**Digestive System.**
similar to those of ipecac, save th
sioning more distressing nausea at

Circulatory System.—Lobelia is
its action being due both to dir
paralysis of the vasomotor center
heart stops in diastole.

Nervous System.—Full doses o
Poisonous doses are necessary to s
when coma and convulsions are
nerves themselves are unaffected l

Respiratory System.—The mus
relaxed by the drug. The respi
doses. Large or toxic doses pro
center, death resulting from respir

Absorption and Elimination.—
readily absorbed, and is excreted
skin, the drug acting as a diuretic
doses much of the drug is elimin
intestines.

Temperature.—Full doses lowe

Untoward Action.—Does not c
of poisoning.

Poisoning.—The symptoms
purging, a very weak and irregula
tenance, skin cold and bathed in
very feeble, contracted pupils, an
preceding death, which occurs fro

Treatment of Poisoning.—The

acted by cardiac and respiratory stimulants, employing such drugs as atropine, strychnine, alcohol, ammonia, etc., hypodermically.

Therapeutics.—*Externally and Locally.*—None.

Internally.—While formerly lobelia was used extensively as an emetic, at the present day, owing to the intense nausea and great depression occasioned by the drug, it has been practically supplanted by other less dangerous emetics.

Its principal use nowadays is as a remedy in *spasmodic asthma* and as an expectorant in certain cases of *bronchitis*.

Contraindications.—The same as for emetics in general.

Administration.—The powder, fluidextract, or tincture may be used.

CATHARTICS.

Cathartics or Purgatives are substances which cause evacuation of the bowels either by direct local irritation of the intestinal mucous membrane or by setting up an osmotic current from the tissues toward the lumen of the intestines, causing an accumulation of fluid in the bowels—in both cases causing increased peristalsis and watery or semisolid evacuations.

Mechanism of Purgation.—It should be remembered that the epithelial surfaces through which the substances needful to the body enter it, and the waste-products leave it, are physiologically outside the body. The mucous membrane of the alimentary canal is in a sense as much external as the skin covering the surface of the body and is subject to the same irritating influences. The muscular mechanism of the intestines is somewhat peculiar in that it possesses the power to rhythmically contract and relax in a wave-like manner (peristalsis), the peristaltic wave traveling downward. These rhythmical movements of the intestines carry their contents along their lumen from the cardia to the rectum, and are to a large extent independent of the central nervous system, although controlled by nervous mechanisms. The normal contents of the small intestine are fluid, and are passed into the large intestine as such. In their passage along the large bowel the fluid part is largely absorbed and the semisolid part remaining is passed on into the rectum as feces.

In order that any substance may act as a purgative it must change the normal contents of the bowels in such a way as to cause fluid or semisolid evacuations. When a substance locally irritates the intestinal mucous membrane the intestines respond by increased peristalsis, which hurries the fluid contents of the small intestine through the large bowel so rapidly that absorption does not take place and the feces are evacuated in a fluid form.

Cathartics may be classified according to their various actions, the following table serving to show how and where the various drugs exert their several influences.

1. Classification according to their Mode of Action.

Laxatives	Simple purgatives	Hydragogue purgatives	Drastic purgatives.
Cassia.	Aloes.	Croton oil (small doses).	Cathartic acid (hypodermically).
Castor oil.	(Calomel.*	Elaeterin.	Colocynth.
Cascara sagrada.	Cascara sagrada (full doses).	Gamboge.	Croton oil.
* Glycerin.	Castor oil (full doses).	Salines	Elaeterin.
* Magnesia.	Ox gall.	Magnesium citrate.	Gamboge.
* Magnesium carbonate.	Rhubarb.	Magnesium sulphate.	Jalap.
Manna	Euonymus.	Potassium bitartrate.*	Scammony.
Sulphur.	Iris.	Potassium sulphate.	Podophyllin.
Taraxacum.	Juglans.	Potassium tartrate.*	
There are certain drugs which are not classed as cathartics, which are sometimes prescribed by physicians as laxatives, such as—	Leptandra.	Potassium and sodium tartrate.	
Belladonna.*	Senna.	Sodium phosphate.	
Ergot.*		Sodium sulphate.	
Hyoscyamus.*			
Nux vomica.*			
Physostigma.*			
Stramonium.*			

Certain articles of diet are laxatives, such as bran, lucum, brown bread, ginger-bread, oatmeal, figs, honey, molasses, prunes, raspberries, strawberries, tamarinds, olive oil, etc.

2. Classification according to their Manner of reaching the Intestinal Mechanism.

By first contact	By circulation contact	By excessive contact
Nearly all the drugs used as cathartics.	Morphine.*	Aloes.
	Muscarine.*	Castor oil.
	Physostigma.*	Croton oil.
	Pilocarpine.*	Colocynth.
	Strychnine.*	Elaeterin.
		Podophyllin.
		Rhubarb.
		Senna.

3. Conditions of the Intestines affecting the Action of Drugs.

Drugs requiring the presence of an alkali or bile to act	Drugs requiring the presence of an acid to act	Drugs not requiring the presence of either alkali, bile, or acid.
Aloes.	Magnesium carbonate.*	Castor oil.
Elaeterin.	Magnesia.*	Colocynth.
Gamboge.		Croton oil.
Jalap.		Euonymus.
Scammony.		Iris.
Sulphur.		Leptandra.
		Magnesium citrate.
		Magnesium sulphate.
		Podophyllin.
		Potassium and sodium tartrate.
		Rhubarb.
		Senna.
		Sodium phosphate.

{Drugs marked with an asterisk (*) are here given in detail; others are described elsewhere.}

4. Classification according to the Anatomical Portion of the Intestinal Canal on which they Act.

Small intestine.	Colon	Ileo-caecal colon and rectum.
Calmel *	Colecynth	Aloes.
Cassia oil.	Elaterium.	
Jalap.	Camboge.	
Leptandra	Magnesium citrate.	
Podophyllin.	Magnesium sulphate.	
Rhubarb.	Potassium bitartrate.*	
Sesamum.	Potassium sulphate.	
Senna.	Potassium tartrate.*	
	Potassium and sodium tartrate.	
	Sodium sulphate.	

5. Classification of Cathartics according to Other Actions.

Stomachics	Hepatic stimulants and cholerics	Colicagogues	Rendering the walls peristaltic	Increasing peristaltic force
Aloes.	Aloes.	Cassia oil.	Aloes.	Aloes.
Cassia sagrada.	Coccyth.		Cassia oil.	
Euonymin	Colechin.		Rhubarb.	
Leptandra.	Euonymin.		Senna.	
Indin.	Indin.		There are probably some substances that affect the walls.	
Rhubarb	Leptandrin.			
	Podophyllin.			
	Sodium phosphate			
	Sodium sulphate			
	Cholerics			
	Aloes.	Mercury with chalk *		
	Calmel *	Nitrohydrargyri *		
	Colecynth	Podophyllin.		
	Euonymin.	Rhubarb.		
	Indin.			

(Drugs marked with an asterisk (*) are here given in detail, others are described elsewhere.)

Intestinal peristalsis is increased probably by:

Stimulation of:

1. The intestinal muscles (moderate stimulation);
2. The afferent nerves connecting the intestinal mucous membrane with Auerbach's ganglia,
3. Auerbach's ganglia,
4. The ends of the efferent nerves passing from Auerbach's ganglia to the intestinal muscles,
5. The ends of the afferent nerves passing from the intestinal mucous membrane to the brain;
6. The motor centers in the brain,
7. The ends of the motor nerves terminating in Auerbach's ganglia.

Depression of:

8. The inhibitory motor center;
9. The ends of the inhibitory motor nerves terminating in Auerbach's ganglia,
10. The inhibitory motor center in the suprarenal plexus

It will be seen that any substance which stimulates the motor apparatus or depresses the inhibitory motor mechanism will increase peristalsis.

Intestinal secretion may doubtless be promoted by any substance which serves to stimulate the secretory or the vasodilator apparatus, or to depress the inhibitory secretory or vasoconstrictor mechanism.

The methods by which absorption is diminished are not thoroughly understood, but it is known that:

1. By increasing peristalsis and hastening the removal of fluid from the bowels absorption takes place less rapidly;
2. By giving drugs—*e. g.*, magnesium sulphate—having high osmotic equivalents, with a great affinity for water, the absorption of fluid is prevented;
3. Substances which in some manner affect the columnar epithelium of the intestinal glands retard absorption,
4. Drugs which diminish the circulation in the intestinal mucous membranes act as deterrents to the absorptive process

It is apparent that certain drugs produce various effects, and that their mode of action varies according to the size of the dose and occasionally with the idiosyncrasy of the patient.

Nearly all cathartic drugs act by some local influence upon the intestinal mucous membranes previous to absorption; others, again, affect the bowels after they have entered the circulation—strychnine, for example, physostigmine, pilocarpine, etc., acting in this manner.

Certain other drugs, such as podophyllin, colocynth, etc., if injected into the circulation, are excreted by the mucous membrane of the intestines, and by their irritation produce catharsis.

The condition of the intestinal canal has much to do with the activity of certain drugs. Thus, certain medicines produce catharsis regardless of the reaction of intestinal fluids; others are inert without the presence of bile or other alkaline fluids or salts; and still a third class occasion catharsis only when after ingestion they come in contact with an acid. Of the last-mentioned, magnesium carbonate is an excellent example, the drug being inert unless it be acted upon by an acid in the stomach or bowels.

It is an interesting fact that, as shown by experience, different cathartics may act more energetically upon different portions of the intestines. The action of calomel, for instance, is almost entirely confined to the duodenum, while aloes acts largely upon the descending colon and the rectum.

In selecting a cathartic, therefore, a knowledge of the part of the intestinal canal to be acted upon and the locality in which the drug operates is necessary in order to secure the most satisfactory results.

Many cathartics contain principles which render them tonic to the stomach; some few are thought to directly stimulate the hepatic cells—mercury preparations; while the cholagogues merely

hasten the expulsion of the bile from the intestinal canal, preventing its absorption.

Certain drugs, being excreted in the milk, which it renders purgative, are well adapted for administration to the nursing mother in order to produce catharsis in the infant. Castor oil, greatly augmenting the secretion of milk, is an excellent medium as a laxative in such cases.

Aloes increases the menstrual flow, other drugs promote the secretion of urine, etc.

Therapeutics.—Cathartics are employed:

To remove feces and produce a simple evacuation of the bowels. The laxatives are best adapted for this purpose.

For the relief of chronic constipation. For this purpose great judgment is requisite in the selection of a drug or combination of agents, it being important to determine whether there is diminished peristalsis or secretion, whether there exists an atonic condition of the intestinal muscles, or whether the disorder is located in the small intestine, the colon, or the rectum.

To remove from the bowels noxious substances or pathogenic matter. For this purpose the mercurial preparations, calomel or gray powder, are best, since they are not only active cathartics, but bactericides as well.

To stimulate the torpid liver. For this purpose the hepatic stimulants would naturally be employed.

To lessen the activity of the liver, as in bilious conditions. In such cases the cholagogue cathartics should be used.

To deplete the gastroduodenal mucous membrane, where the congested and swollen mucous membrane obstructs the outflow of bile, resulting in jaundice. In this condition the salines, especially the sodium salts, are the most efficient cathartics.

To promote absorption and remove dropsical effusions in certain diseases of the heart, liver, and kidneys. Here active catharsis is necessary, the hydragogue cathartics being indicated.

To remove urea, etc., from the blood. Occasionally in certain renal diseases the functional activity of the kidneys is so defective that waste matter, urea, etc., rapidly accumulates in the body, occasioning uremic convulsions, coma, or other serious symptoms. In such cases it may be necessary to give a drastic purgative, such as croton oil, which acts rapidly, causing profuse watery stools.

To lower the blood-pressure where high arterial tension aggravates a malady, as at the onset of many acute diseases, and in cerebral hemorrhage, meningitis, etc. In these conditions it is necessary to employ such drugs which by dilating the intestinal blood-vessels drain the blood away from other organs and cause abundant watery discharges from the bowels. Hydragogue or drastic purgatives answer the required purpose.

For the relief of hemorrhoids, in which cases the mild laxatives, such as sulphur, senna, etc., are serviceable.

To aid the resolution of the catamenia. For this purpose aloes

is usually employed, particularly more blood to the pelvic organs, selection should be made from the

To purge the nursing infant through purpose such drugs as rhubarb, set istered to the mother.

To lower the temperature in cathartics may be advantageously

Contraindications.—Active cathartics or drastic purgatives, appendicitis, peritonitis, typhilitis, in typhoid fever, or where there is inflammation of the gastro-intestinal tract.

Administration.—Probably no greater judgment in the administration

Ordinarily, the efficiency of the operation rendered less irritant by different portions of the alimentary more prompt and certain when the empty stomach and the efficiency of exercise and diminished by sleep.

The action of cathartics is promoted by doses of emetics, mydriatics, quinine strengthening the action of mag beverages also promote the action to the abdomen, enemata, massage, electricity, all act as adjuvant to purgative medicines.

As has been previously suggested of the intestinal canal upon which primary importance. Thus, if in the duodenum, calomel or podoph small intestine, senna or jalap; if aloes—these drugs acting chiefly

Moreover, due consideration should for the administration of the cathartics acting best when taken at salines when taken in the morning

The mode of administration in order to obtain from these agents for instance, act best when given in very hot water, their activity being bitters, iron, or sulphuric acid. Cathartics should be administered in this reason, it is desirable that the drug should not coming in contact with the mucous the drug may be given in the form which is unaffected by the gastric the alkaline intestinal juices.

In the following detailed description cathartic drugs are grouped according to their *modus operandi*, the mildest drugs or laxatives being first considered.

LAXATIVES.

Certain substances never produce active purgation, but simply unload the bowels by slightly increasing both peristalsis and secretion, expelling the feces in a softened, though solid and formed, condition, without irritation and without perceptibly affecting the general system.

These agents are especially useful where we wish to evacuate the bowels with the least possible local derangement, as in simple constipation from dyspepsia, in children, pregnant women, convalescents from acute disease, or patients affected with hemorrhoids, hernia, affections of the rectum or womb, typhoid fever, early simple diarrhea, or in inflammation or surgical operations about the abdomen and pelvis.

In addition to the laxative drugs here mentioned there are many articles of diet which by purely mechanical action produce catharsis, such as oatmeal, brown bread, whole flour, molasses, prunes, figs, onions, spinach, celery, lettuce, etc.

Cassia Fistula—Cassiae Fistulae—Cassia Fistula.

U. S. P.

(PURGING CASSIA.)

Origin.—The dried fruit of *Cassia Fistula* L., a tree 30 to 50 feet (9-15 M.) high, indigenous in the East Indies.

Description and Properties.—A cylindrical, 1½ to 2 feet (45 to 60 Cm.) long, nearly 1 inch (25 Mm.) in diameter but much broader somewhat toward the center, usually bearing two longitudinal, flattened, imbricated, obtuse, slightly irregularly imbricated wings, each containing a reddish-brown, glossy, lustrous seed imbedded in a thickish, tough, light-colored, viscid, mucous, pulpy mass.

Dose.—1-2 drams (4-8 Gm.) (1 dram (4 Gm.), *U. S. P.*)

Official Preparation.

Confectio Sennae—Confectio Sennae—Confection of Senna.—Described under *Senna*.

Physiological Action and Therapeutics.—Cassia is a mild and pleasant laxative. It is seldom given alone, however, but forms an ingredient in the confection of senna.

Öleum Ricini—Ölei Ricini—Castor Oil. *U. S. P.*

Origin.—A fixed oil expressed from the seed of *Ricinus communis* L., a joint indigenous in Southern Asia and introduced in temperate countries for ornament and other purposes requiring large doses.

Description and Properties.—A pale yellowish or almost colorless, translucent, viscid liquid, having a faint, mild odor and a faint, somewhat oily and indistinctly acrid taste. Similar in appearance to common and pure vegetable oils. Castor oil should be known as a pure, colorless, tasteless, and odorless liquid.

Dose.—½ a fluidounce (30-60 Gm.) (4 fluidrams (12 Gm.), *U. S. P.*)

Physiological Action.—*Externally* like other bland fixed oils, such as olive oil, is sedative and protective when applied to the skin.

Internally—The only important action is on the intestinal tract, on which the oil acts as a cathartic. Chemically castor oil is a combination of glycerine and ricinoleic acid. This combination is not changed, but in the presence of the alkali it is broken up into glycerine and ricinoleate. Ricinoleate combines with sodium and forms sodium ricinoleate, which has irritating properties. The ricinoleate is excreted in various ways, appearing in the urine, imparting to it purgative properties.

Castor oil requires from four to eight ounces, being usually attended with little pain, and usually empties the entire intestine.

The poisonous principle, ricin, found in castor beans, is an albuminous substance, and is generally termed a toxicogenin. It is one of the most powerful poisons known, but being soluble in water it is not present in expressed castor oil. Poisoning from castor beans are very rare, and are usually attended with vomiting, purging, and collapse. *Postmortem* evidences of severe inflammation in the intestines and capillary thrombi in various organs.

Castor oil should not be used in children, continual employment being liable to produce habitual constipation and attendant evils.

Therapeutics.—Castor oil is used in the *Sierra de Peru* as a sedative protectant in the treatment of *typhoid fever*. The drug is also serviceable in the treatment of the throat and mouth.

It is probably superior to all other laxatives in the treatment of all conditions for which laxative is indicated. It is one of the best purgatives in the treatment of anthelmintic.

Administration.—The unpleasant taste is the chief objection to its use. Yet it can be overcome by mixing it with a small quantity of orange juice, or a few drops of oil of cinnamon or clove.

Various other devices for disguising the taste, such as enveloping the oil in the mucous membrane, washing out the mouth with brandy, or the use of straws, and allowing the patient to suck on a piece of sugar, it will not adhere to the mouth and will be washed out by a drink of some alcoholic liquid.

In the form of an emulsion the oil is more palatable. There are also soft capsules of castor oil, but they are too bulky to be taken.

Castor-oil emulsion may be used as an enema when a mild injection is required.

Rhâmnus Purshiâna Rhâmni Purshiânæ - Cascara Sagrada. U. S. P.

Origin—The dried bark of *Rhâmnus Purshiâna* L. C., collected at least one year before being used. *Rhâmnus Purshiâna* is a shrub or small tree 10 to 20 feet 4.5 to 6 M. high indigenous to the Pacific coast of North America from the British possessions southward to Northern California.

Description and Properties—Bark of curved pieces about $\frac{1}{8}$ to $\frac{1}{4}$ inch (1 to 1 cm.) long and about $\frac{1}{16}$ to $\frac{1}{8}$ in. (2 Mm.) thick, outer surface brownish grey and smooth, the young bark with a few rather broad, more or less warty, scurfy scales with a light brownish, becoming more brown with age, sometimes hairy stem, fracture short, yellowish, in the inner layer of thick bark somewhat fibrous, innermost taste bitter.

The bark contains red, yellow, and brown resins, containing anthracene, free acids—anthracic, castic, malic, and malic acids, a volatile oil, and possessing a glycoside, *cas-carin*, rhâmnus or cascarin.

Dose—30 to 60 grains (2 to 4 Gm.) (15 grains (1 Gm.) U. S. P.)

Official Preparations

Fluidestrâctum Rhâmni Purshiânæ Aromâticum Fluidestrâcti Rhâmni Purshiânæ Aromâticæ—Aromatic Fluidestrâct of Cascara Sagrada U. S. P.—This is the aromatic fluidestrâct of cascara sagrada of the *Normal Pharmacopœia*. It differs from the fluidestrâct, which was already official, in being an aromatic flavoured liquid, devoid of the extremely bitter principle occurring in the bark.

Average dose—15 grains (1 Gm.) U. S. P.

Extrâctum Rhâmni Purshiânæ Extrâcti Rhâmni Purshiânæ—Extrâct of Cascara Sagrada U. S. P.—the part of the solid extract represents the activity of four parts by weight of the bark.

Average dose—4 grains (0.25 Gm.—250 milligrammes), U. S. P.

[This represents 15 grains (1 Gm.) of the bark and is equal to the Pharmacopœial dose of the fluidestrâct, namely, 15 grains (1 Gm.)]

Physiological Action—Cascara sagrada is a peculiarly efficient laxative although in certain individuals it appears to be inert unless associated with other purgatives. The bitter principle it contains gives to the drug its tonic properties.

The action of cascara is seldom attended with irritation or unpleasant symptoms, the drug requiring from six to ten hours to operate.

Therapeutics—Cascara is a very valuable laxative, being employed chiefly to overcome *habitual constipation* due to simple torpor of the colon without associated disease. The drug is not adapted for rapid evacuation of the bowels, but rather for regulating their action.

Administration—The fluid and solid extracts are usually employed, although the cascara cereal and the aromatic fluidestrâct, while requiring larger doses, are so palatable that they have become deservedly popular.

Whatever be the preparation used in cases of habitual constipation it should be given in small but repeated doses gradually diminished until a natural action of the bowels shall have been

established. The drug should be given on an empty stomach and in as diluted a condition as possible.

Magnēsii Ōxidum—Magnesium Oxidum.

(LIGHT MAGNESIA; CASHEW NUTS.)

Origin, Description, and Properties.—See *Magnesium*.

Dose.— $\frac{5}{8}$ –60 grains (0.32–4.0 Gm.) [30]

Magnēsii Carbōnas—Magnesium Carbonate.

Origin, Description, and Properties.—See *Magnesium*.

Dose.— $\frac{1}{2}$ –2 drams (1.0–8.0 Gm.) [45]

Physiological Action.—Both magnesium carbonate and magnesium oxide are mild antacid laxatives. They neutralize excess of acid in the stomach and bowels to a certain extent, and, when there is marked acidity, they may occasion flatulence.

When taken in large amounts they may accumulate in the intestines. They may be given with lemonade, which increases the solubility of the magnesium carbonate.

Therapeutics.—MAGNESIUM CARBONATE is an effective agent in the treatment of constipation and *auditory passage*. The drug is also used in the treatment of the effects of *phosphorus-poisoning*.

Both MAGNESIA and MAGNESIUM CARBONATE may be used for the same purposes as the above, and may be used for the same purposes as the above, and may be used for the same purposes as the above.

Mānna—Männæ—

Origin.—The concrete, saccharine exudate of the date palm, indigenous on the northern shore of the Mediterranean Sea.

Description and Properties.—It is a white, crystalline, and somewhat translucent substance, 8 inches (20 Cm.) long and 2 inches (5 Cm.) wide. It is externally yellowish-white, internally white, and has a different size, brownish white, and somewhat translucent. It is crystalline; odor honey like, taste sweet. Manna contains a resin, the purgative principle.

Dose.— $\frac{1}{2}$ –1 ounce (16.0–32.0 Gm.) [15] in hot water.

Official Preparation.

Infusum Sennæ Compositum—Infusion of Senna.—See *Senna*.

Physiological Action and Therapeutics.—Its action is cholagogue, and nutrient. Its

drug peculiarly efficient in *constipated conditions* of pregnant women, and children and persons suffering from *piles* or *irritation of the genito-urinary tract*.

The drug is slow in its action, tending to confine the bowels after the primary laxative effect.

Sulphur Sublimatum—Sulphuris Sublimati— Sublimed Sulphur. U. S. P.

Origin—Obtained from crude sulphur by sublimation.

Description and Properties—A fine yellow powder, having a slight characteristic odor and a faintly acid taste. Insoluble in water, slightly soluble in alcohol, more readily soluble in benzoin, benzene, oil of turpentine, and many other oils, as well as in ether, chloroform, and forming aqueous solutions of alkaline hydrates.

Dose.—15-60 grains (1.0-4.0 Gm.) [60 grains (4 Gm.), U. S. P.]

Official Preparations.

Sulphur Lotum—Sulphuris Loti—Washed Sulphur *Origin*—Sublimed sulphur, 100 water, q. s., a menstr. water, 10. *Prepared*, *Tested*, *Drained* and *Dried*. *Description and Properties*—A fine yellow powder, without odor or taste. Insoluble in water, but soluble in the substances which dissolve sulphur.

Dose.—15-60 grains (1.0-4.0 Gm.) [60 grains (4 Gm.), U. S. P.]

Unguentum Sulphuris—Unguenti Sulphuris—Sulphur Ointment—Washed sulphur, 150; benzoated lard, 850. *For external use*.

Washed sulphur is an ingredient of compound *laxative powder*.

Sulphur Precipitatum—Sulphuris Precipitatis—Precipitated Sulphur *Mix.* of *Sulphur*, *Lax.* *Sulphur*. *Origin*—Sublimed sulphur is heated and, diluted with water. To the solution is added hydrochloric acid which throws down sulphur as a fine precipitate, the powder being washed and dried.

Description and Properties—A fine amorphous powder of a pale yellow color, without odor or taste. Insoluble in water.

Dose.—15-60 grains (1.0-4.0 Gm.) [60 grains (4 Gm.), U. S. P.]

Physiological Action.—*Externally and Locally*—Sulphur is an active parasiticide, antiseptic, and keratoplastic agent. Upon the skin the drug of itself has no influence, a portion of it however, is converted into hydrogen sulphide, which acts as a mild cutaneous irritant.

Internally—As observed, sulphur proper has no action either externally or locally, although it is a normal constituent of nearly all the solids and fluids of the body. When ingested some of it is converted into hydrogen sulphide and other sulphides, which increase the intestinal secretions and promote peristalsis.

The drug is chiefly excreted with the stools, which are rendered soft and semiliquid. A portion of the hydrogen sulphide formed is eliminated through the kidneys, lungs, skin, and milk-glands. The drug is usually found in the urine as a sulphate.

There is imparted to the breath the offensive odor of hydrogen sulphide, and the minute portion eliminated through the skin is sufficient to discolor silver ornaments in contact with the surface of the body.

While hydrogen sulphide is a powerful poison, decomposing the blood and paralyzing the nervous and muscular systems, the

amount formed and absorbed under is too small to produce marked effects. Large amounts of sulphur have been used only violent vomiting and purging, ture, and a distinct odor of hydrogen sulphide.

When sulphur is used in full doses it impairs the quality of the blood and occasionally untoward manifestations such as eczema, accompany either the external use of the drug.

As a laxative sulphur is slow and causes considerable flatulence, in some cases it is objectionable as a purgative.

Therapeutics.—*Externally* and as a laxative drug, SULPHUR is a most efficient one of the *skin, nose, throat, etc.*, the diseases are very numerous.

The drug is perhaps the most successful in *scabies*, SULPHUR OINTMENT well used is sufficient to destroy the parasite.

Even diseases induced by vegetable poisons, *versicolor*, etc., are cured by inunction.

The drug is successfully employed in *eczema, impetigo, sycosis, etc.*

The FLOWERS OF SULPHUR is an efficient one, in *diphtheria* and *scarlatina* and Duchane have both reported success in *sciatica* by enveloping the affected part in the profuse sweating induced by the use of the drug.

When SULPHUR is burned in moist air, which, if large quantities are confined, produces moist steam, is a fair disinfectant. The old-fashioned methods of sulphur being farcical.

Internally.—The principal internal use of sulphur is as a laxative, the drug being especially useful in *hemorrhoids* or *anal fissure*.

LOZENGES are prepared containing sulphur, which, if taken daily for some time, produces a profuse sweating.

SULPHUR has been used with considerable success, in *bronchitis*, and is attended with much itching.

Administration.—Sulphur may be given in lozenges or mixed with molasses—citric acid or tartar, which is said to enhance its action. Syrup have been used as vehicles for the drug.

Sulphurous baths, both natural and artificial, have been employed in the treatment of *rheumatism, gout, and some cutaneous affections*. Not only for these purposes, but for their laxative influence as well, sulphurous waters are held in great repute.

Taraxâcum—Tarâxaci—Taraxacum. *L. N. P.*

(DASHING)

Origin—The dried root of *Taraxacum officinale* Weber, a perennial, aculeous herb (and) in most countries of the northeast, temperate

Description and Properties. Slightly conical, about 12 inches (30 Cm.) long and $\frac{1}{2}$ to 1 inch (12-25 Mm.) thick above, crowned with several short thickish beards, somewhat branched, dark brown, long setae $\frac{1}{2}$ to 1 inch (12-25 Mm.) long with a short fascicle, showing a very weak, perianthial axis surrounded by a thick white bark containing numerous milk vessels arranged in concentric circles, imbedded in tissue.

The drug contains a better principle, *sarsaparilla*, besides *iodine*, resin, sugar, and

Dose.—1-4 drams (40-150 Gm.) (2 drams (8 Gm.), U. S. P.).

Official Preparations.

Extractum Taraxaci. *Extractum Taraxaci.* *Extract of Taraxacum.*—*Dose,*
 ʒi-ʒss. ʒss-ʒi. ʒi-ʒss. ʒss-ʒi. ʒi-ʒss. ʒss-ʒi. ʒi-ʒss. ʒss-ʒi. ʒi-ʒss. ʒss-ʒi.

Pluendistratum Taraxaci. *Pluendistracti Taraxaci*. *Pluendistracti of Tarax-*
acum. — *Proc.* 1-4 *Humilis* 14-15 0' < 1/3 *Humilis* (S. C. L. S. P.).

Physiological Action and Therapeutics.—Taraxacum is a stomachic tonic, diuretic, laxative, cholagogue, and feeble hepatic stimulant. It has been a popular remedy for *constipation* associated with *hepatic congestion* and *atonic dyspepsia*, yet the drug is now less employed than formerly, in actual practice being usually united with other laxatives.

The extract or fluidextract may be given, the latter and the expressed juice being the more active.

SIMPLE PURGATIVES

These differ from laxatives only in degree, the former being more active, exciting greater peristaltic action and causing a larger secretion from the intestinal glands. Simple purgatives usually occasion one or more copious and somewhat liquid stools, frequently accompanied by considerable irritation and griping.

Aloe—Äloes Aloes. U. S. P.

[illegible]

Догод. 1. 10. 1920. 1. 10. 1920. 1. 10. 1920.

Official Prepara-

Extractum Aloes—Extracti Aloes—Es
(0.03-0.4 Gm.) (2 grains (0.125 Gm.)), U. S. P.

Aloe Purificata—Aloes Purificata—Pur
0.6 Gm.) (4 grains (0.25 Gm.)), U. S. P.).

Pilulæ Aloes—Pilulas (acc.) Aloes—Pi

Pilulæ Aloes et Ferri—Pilulas (acc.)
Iron. Each pill contains about 1 grain (0.07
phate, and aromatic powder.

Dose.—1 to 4 pills.

Pilulæ Aloes et Mastiches—Pilulas (
Aloe and Mastich.—Each pill contains abo
mastich and red rose (Lady Webster's Dinner I

Dose.—1 to 3 pills.

Pilulæ Aloes et Myrrhæ—Pilulas (acc
and Myrrh.—Each pill contains 2 grains (0.
matic powder.

Dose.—1 to 3 pills.

Pilulæ Rhæi Compositæ—Pilulas (acc.)
of Rhubarb.—Each pill contains 1½ grains (0

Dose.—1 to 3 pills.

Pilulæ Laxativæ Compositæ—Pilulas
Laxative Pills. U. S. P. —Each pill contain
abou. 1½ grain (0.0005 Gm.—0.5 milligram
m.—grammes) extract of belladonna leaves, an
of opium.

Dose.—Average dose: 2 pills (U. S. P.).

Pilulæ Alois, strychninæ et belladonnæ (D
Ipecac, the same active ingredients and in the

Tinctura Aloes—Tincturæ Aloes—Ti

Dose.—½ fluidram (20-40 Cc.) [30 ml]

Tinctura Aloes et Myrrhæ—Tincturæ
and Myrrh (10 per cent. of each, with glycer

Dose.—1-2½ fluidrams (20-100 Cc.) [30

Tinctura Benzoini Compōita—Tincti
Tincture of Benzoin (2 per cent. of aloes).

Dose.—10-30 minims (0.5-2.6 Cc.). [30

Aloinum—Aloini—Aloin (U. S. P.).—
from several varieties of aloes.

Description and Properties.—Minute acic
varying in color from yellow to yellowish bro
of aloes, of a characteristic, bitter taste, and

Dose.—½-2 grains (0.03-0.12 Gm.) [1 gr

Extractum Colocynthis Compōitū
—Compound Extract of Colocynth.—D.
(0.5 Gm.), U. S. P.). (See *Colocynth*)

Physiological Action.—Aloe
the drug is readily absorbed from

Internally it is stomachic, inc
gastro-intestinal tract. It probabl
Its principal action appears to be
coat of which it stimulates, in add
from the large intestine.

In from ten to fifteen hours a
causes soft, dark-colored evacu
attended with more or less griping

The blood-supply to the lower bowel and pelvic viscera is increased by aloes, and the drug, if used habitually, may bring on or aggravate hemorrhoids. The menstrual function is stimulated the drug being a decided emmenagogue.

Aloes is readily absorbed, it is eliminated through the bowels and kidneys, and is found also in the milk.

Therapeutics—The principal use of aloes is as a purgative in *habitual constipation* due to a torpid condition of the large intestine. *Jaundice* resulting from gastro-intestinal catarrh is well treated with aloes and blue pill.

PILLS OF ALOES AND IRON are useful adjuvants to other remedies in the treatment of *chlorosis*. *Amenorrhoea*, which is such a common condition in chlorosis, is relieved by aloes. Pills of aloes and iron are equally valuable in *menorrhagia* arising from debility.

Contraindications—Aloes is ordinarily contraindicated in hemorrhoids, although those cases attended with a mucous discharge are frequently benefited by it. The drug is considered objectionable in pregnancy, in persons of plethoric, bilious, or hemorrhagic constitution, and in menorrhagia of the strong and full-blooded.

Administration—When desired as a purgative, aloes in pill form is preferable to the liquid preparations, and the drug may be given alone or associated with other purgatives, tonics, or antispasmodics.

Aloin is perhaps to be preferred to aloes, as it gripes less and may be given in smaller doses. It is less certain, however.

Fœl Bôvis—Fœllis Bôvis—Oxgall. U. S. P.

Origin—The fresh bile of the *Bovæ*.

Description and Properties—A brownish green, viscid, green, somewhat sweet, having a peculiar, somewhat bitter and a disagreeable, bitter taste.

Dose—5-15 grains (0.3-1.0 Gm.).

Official Preparation.

Fœl Bôvis Purificatum—Fœllis Bôvis Purificata—Purified Oxgall—*Description and Properties*—A viscid green, with a faint yellow color and a purely sweet and pure bitter taste. Very soluble in water and in alcohol.

Dose—5-15 grains (0.3-1.0 Gm.) (7½ grains (0.5 Gm.), U. S. P.).

Physiological Action and Therapeutics—Like bile oxgall augments the duodenal secretions, emulsifies fats, and increases intestinal peristalsis. It renders bile more fluid, and acts as a cholagogue and purgative. It is a useful cathartic when the stools are very offensive and of a light-clay color, indicating a deficient biliary secretion. The drug is serviceable in *jaundice* due to obstruction of the common duct by inspissated bile or mucus. *Impacted feces* are readily removed by an enema containing 15 or 20 grains (1.0-1.3 Gm.) of oxgall. The drug is an efficient intestinal antiseptic, and may be beneficially employed for that purpose in *typhoid fever* and *intestinal fermentation*.

Oxgall is usually given in pill form.

Rhëum—Rhêi—Rh

Definition.—The dried rhizome of *Rh* 1., and the var. *longitarsus* Max. or other Thibet, and deprived of most of the bark and

Description and Properties.—In deprived of the dark brown, corky layer, and covered with a bright yellowish brown powder containing a white, rather spongy tissue, as brownish yellow striae, compact, hard, & numerous red, irregularly curved and interrupted only near the cambium line, odor is somewhat astringent. When chewed, rhub imparts a yellow color to the saliva. Rhub nently mucilaginous taste, or is of a dark br

The drug contains the following constituents: emodin, imperfectly isolated glycoside, tannic acid, starch, calcium oxalate, etc.

Dose.—5–30 grains (0.32–1.94 Gm.) [1]

Official Pre

Extractum Rhêi—Extracti Rhêi—E (0.19–1.0 Gm.) [4 grains, 0.25 Gm., U. S.]

Fluïdextrâctum Rhêi—Fluïdextrâct (This preparation is used in *Miscura Rhêi et*

Dose.—5–30 minims (0.3–2.0 Cc.) [15 m

Pillulæ Rhêi Compôsîtæ—Pillulæ

Rhubarb Pills.—Each pill contains about 1 tied aloes 1½ grains (0.09 Gm.), myrrh, and

Dose.—1 to 3 pills

Pulvis Rhêi Compôsîtus—Pulveris

Powder (GREGORY'S POWDER)—(25 per ce

Dose.—¼–1 dram (2.0–4.0 Gm.) [30 gr

Tinctûra Rhêi—Tincturæ Rhêi—Tû

cardamom).

Dose.—¼–4 fluidrams (2.0–15.0 Cc.) [1

Tinctûra Rhêi Aromâtica—Tinctûra

of Rhubarb.—20 per cent, with cassia, cin

Dose.—1–3 fluidrams (4.0–12.0 Cc.) [30

This preparation is used to make *Syrupus*

Mistûra Rhêi et Sôdæ—Mistûræ Rî

Soda. Formula: Sodium bicarbonate, 35;

opelac, 3; glycerin, 350; spirit of peppermi

Dose.—¼–2 fluidounces (8.0–60.0 Cc.) [1

Syrûpus Rhêi—Syrûpi Rhêi—Syrup

rhubarb, 100; potassium carbonate, 10; spi

1000

Dose.—1–4 fluidrams (4.0–15.0 Cc.) [2

Syrûpus Rhêi Aromâticus—Syrûpi

Rhubarb.—Formula: Aromatic tincture

syrup, 850.

Dose.—¼–2 fluidrams (2.0–8.0 Cc.) [2]

Physiological Action and Therapeutic Uses.—In moderate doses is a stomachic, acting increasing secretion, peristalsis, and aiding digestion and serving as mild cathartic, producing in from ish-brown evacuation, not watery, panied by griping.

After full doses of rhubarb hav

is succeeded by quiescence of the bowels, the constipation being the result of the action of the astringent constituents of the rhubarb. Small doses, however, taken daily, serve a useful purpose in relieving *habitual constipation* without in the least impairing digestion.

The drug is excreted with the feces, urine, perspiration, and milk, the urine is slightly increased in amount and, together with the perspiration and milk, is colored yellow. The milk acquires a bitter taste and purgative properties.

Rhubarb is one of the best purgatives for children suffering from *diarrhea* caused by irritating ingesta in the bowels or to cost, it is also of value in some cases of *dysentery*. *Summer diarrhea of children* is often cured by some preparation of rhubarb alone, the diarrhea ceasing after a free purge by the drug.

As a simple laxative for children it is a valuable remedy, owing to its secondary tonic and astringent effects, and is recommended as a laxative to expel *throat-worms*.

When *hemorrhoids* are connected with constipation, much relief may be obtained by the gentle action of rhubarb.

Administration.—Rhubarb is seldom given alone, because of the griping it occasions. For children the syrups are excellent preparations, and the mixture of rhubarb and soda is an appropriate remedy when the secretions of the stomach and bowels are unduly acid.

In habitual constipation of adults the simple rhubarb pill is an efficient preparation.

The choice of the preparation will depend largely upon the individual case.

Euonymus—Euonymi—Euonymus. P. S. P.

WALTON.

Origin.—The dried bark of the root of *Euonymus alatus* (Lamour.) Desr., a shrub 6 to 10 or 12 feet high, 1 to 2 M. high, found growing in dense woods of the northern and middle sections of the United States, and of the Mississippi.

Description and Properties.—The bark is dried from the root, and is 2 to 3 M. thick, outer surface with gray, white, or pinkish, lenticles, in those on which scales, inner surface with a finely granular, smooth, fracture smooth, without the inner layers of a vascular apparatus, heart-shaped, taste sweetish, somewhat bitter and astringent.

The chief constituent of the drug is a glucoside, *euonymin*.

Dose.—1-2 grains 4 to 8 U. S. M. (7½ grains 0.5 gram, U. S. P.)

Official Preparations

Extractum Euonymi. **Extracti Euonymi.** **Extract of Euonymus.** *Ver.* 1-1 grain 0.065 gram (12 grains 0.8 gram, U. S. P.)

Fluidextractum Euonymi. **Fluidextracti Euonymi.** **Fluidextract of Euonymus.** U. S. P. The fluid extract of euonymus which was already defined in the preparation from the root-contrast.

Dose.—Average dose 3 minims (0.5 c.c., U. S. P.)

Physiological Action and Therapeutics.—Euonymus resembles rhubarb in its action, but is milder, small doses being stimu-

lant to the stomach. The drug increases the secretion of bile and intestine. It is excreted by the mucous membrane, being a mild diuretic. Euonymus is an excellent cathartic, particularly in cases of constipation attended with impaired functional activity.

Euonymin is an impure resin, and a fluidextract of euonymus is a resinous extract.

Leptandra—Leptandræ—

(CULVER'S ROOT)

Origin.—The dried rhizome and roots of *Leptandra virginica* (L.) Nutt., native in Canada, and in the United States as far west as the Rocky Mountains.

Description and Properties.—Of (10-15 Cm.) long and about $\frac{1}{4}$ inch (6 Mm.) thick, branched, deep blackish brown, with cup-shaped woody fracture, with a thin, blackish bark, purplish brown, about six rayed pub., roots 1-2 mm. thick, taste bitter and feebly acrid.

Leptandra contains a crystalline glycoside and a small quantity of volatile oil.

Dose.—15-60 grains (1.0-4.0 Gm.) [15

Official Preparations

Extractum Leptandræ—Extracti Leptandræ.—1-5 grains (0.06-0.3 Gm.) [4 grains (0.25 Gm.)

Fluidextractum Leptandræ—Fluidextracti Leptandræ.—Dose, 15-60 minims (1.0-4.0 Cc.)
The **Pillule Cathartice Vegetabiles** contain 10 minims of the fluidextract of Leptandra in each pill.

Leptandrin (NON OFFICIAL).—Dose, 1-2 grains. A mixture of resins is on the market.

Physiological Action and Therapeutics.—Leptandra is similar to the actions of the green root, however, being more of a stimulant to the intestinal tract, possessing marked emetic and purgative properties.

It is thought to be an active antispasmodic, and is advantageously employed for the treatment of the iris, etc.

Senna—Sennæ—S

Origin.—The dried leaflets of *Cassia angustifolia* Vahl (India senna), sometimes known as *Nuhia*, *Sennaar*, and *Karidjan*, (*Cassia acutifolia*), and in southwestern Arabia eastward in Northern India (*Cassia angustifolia*).

Description and Properties.—Almond-shaped, 1-2 inches (25 Mm.) long and $\frac{1}{4}$ inch (10 Mm.) wide, acceous, brittle, rather pointed, unequally oblong, somewhat pubescent; of a peculiar odor, and

Cassia senna consists of leaflets 1 to 2 inches (10-15 Mm.) broad, lanceolate, acute, unequal at base, yellowish green or dull green, nearly smooth; mucilaginous, bitter, and nauseous.

Senna contains a sulphuretted glycosid,

properties of the drug are due. Senna also contains *desferalium*, besides emacrol and resin, etc. (see also *Pharmacopoeia*, *Calomel*, *Emacrol*, etc.)

Dose. — 10 grains to 3 drams (3.0-12.0 Gm.) (100 grains (4 Gm.) L. S. P.)

Official Preparations.

Confectio Sennæ—**Confectio Sennæ**—**Confection of Senna**—10 per cent with *caustic soda*, *lactated*, *pease*, *fig sugar*, and oil of *coriander*. Dose, 1-3 drams (4.0-12.0 Gm.) (100 grains (4 Gm.) L. S. P.)

Fluidextractum Sennæ—**Fluidextractum Sennæ**—**Fluidextract of Senna**—Dose, 10 minims to 3 ounces (0.6-110 c.) (10 minims (2 c.) L. S. P.)

Infusum Sennæ Compositum—**Infusum Sennæ Compositum**—**Compound Infusion of Senna**—6 per cent, with *caustic soda* and *maple sugar*, each 12 per cent, and *lactated* 2 per cent. Dose, 1-2½ fluid ounces (30.0-75.0 c.) (4 ounces (120 c.) L. S. P.)

Pulvis Glycyrrhiæ Compositus—**Pulvis Glycyrrhiæ Compositus**—**Compound Powder of Glycyrrhiæ**—1-gram Senna, 100, *glycyrrhiæ*, 250, oil of *lemon*, 4, washed on *pot*, No. 1, sugar, 500.

Dose, 1-2 drams (2.0-8 c.) (10 grains (4 Gm.) L. S. P.)

Syrupus Sennæ—**Syrupus Sennæ**—**Syrup of Senna** (25 per cent)—Dose, 4-1 fluid ounce (80-120 c.) (1 fluid ounce (4 c.) L. S. P.)

Syrupus Sarsaparillæ Compositus contains 15 per cent of the *fluidextract of senna*.

Dose — 4 drams (16 Cc.), L. S. P.

Physiological Action and Therapeutics—Senna is an active purgative, acting upon nearly the entire intestinal tract, increasing both peristalsis and intestinal secretion, although having but little effect upon the biliary secretion. It is apt to occasion much flatulence and griping unless it is associated with aromatics. Full doses open the bowels in from four to eight hours, producing one or more copious liquid, yellow stools, but never occasioning hypercatharsis, and the purgation is not followed by constipation.

An infusion of senna, if injected into the veins, excites both vomiting and purging.

Some persons are so susceptible to the influence of senna as to be purged even by its odor.

The drug, or some constituent of it, is eliminated by the urine, to which it imparts a red color, and by the milk, rendering it purgative.

The various preparations of senna are very efficient purgatives in cases of simple constipation or in cases of fecal accumulation in the colon.

Infusions of senna is an admirable purgative with which to succeed the administration of blue pill. In cases of *hemorrhoids* there is probably no better treatment than calomel or blue pill at night and infusion of senna in the morning.

Habitual constipation and the *constipation of pregnancy* are safely and agreeably treated by *compound liquorice powder*.

Administration—Senna is seldom given alone, but is generally associated with some corrective to prevent griping.

The infusion, compound liquorice powder, syrup, and confection of senna are employed.

The compound liquorice powder and the confection being the

mildest and pleasantest, the latter chocolate, is readily taken by children. The known laxative "*Tamar Indien*." The proprietary laxatives contain senna against their use.

HYDRAGOGUE

These drugs are more active in producing an abundant secretion from the biliary ducts, removing a large quantity of bile, and producing several copious, watery stools.

Öleum Tiglii—Ölei Tigli

Origin.—A fixed oil expressed from the seeds of *Croton tiglium* in Hindustan and some of the East Indian Islands.

Description and Properties.—A colorless, viscous, and slightly fluorescent liquid, having a strong, acrid, and burning taste. It should be kept in small, well stoppered bottles, and for when applied to the skin it produces redness and inflammation.

When fresh, croton oil is soluble in alcohol, but becomes insoluble on increasing by age.

Croton oil is broken up into crotonoleic acid, but is much more powerful.

Dose.— $\frac{1}{2}$ minim (0.01-0.12 Cc.) in bland oil [1 minim (0.05 Cc.), U. S. P.].

Physiological Action.—*Externally.*—It is a powerful irritant when applied to the skin, and quickly producing vesication, the pustules closely resembling those of the smallpox, and lasting several days. In many cases the pustules are accompanied by itching.

If the drug be rubbed over the skin, it produces a burning sensation. The irritating action is due to the crotonoleic acid which the oil contains.

Internally.—When a drop or two is swallowed, it occasions a sense of burning in the stomach, soon succeeded by griping and vomiting. In an hour to two hours after the ingestion, it induces profuse watery stools, with tenesmus about the anus.

The drug greatly increases the secretion from the gastro-intestinal tract, the liver, and biliary secretion.

Large doses produce violent effects, with great prostration and collapse.

In case of *poisoning* the stomach should be emptied, and demulcent drinks freely administered may be necessary.

Therapeutics.—*Externally and Locally*—The external use of croton oil is comparatively limited.

Croton oil has been put to many uses, but the results obtained are so unsatisfactory that it is needless to enumerate them.

Internally—The drug is used as a purgative, as a rule, only in cases of emergency, and then a single dose is usually sufficient. It is employed in such cases as *intestinal obstruction from accumulated feces* produced by torpor of the bowels, *diseases of the nervous system*, *lead-poisoning*, etc. In *lead colic* it is probably superior to all other purgatives.

Croton oil is sometimes employed for its revulsive action in *apoplexy*.

As a purgative it is frequently given to the insane because, on account of the smallness of the dose, it may be easily placed on the back of the tongue, where it is quickly swallowed reflexly.

Contraindications.—The drug should never be given to pregnant women, to children, nor to patients suffering from hemorrhoids, peritonitis, gastritis, or enteritis.

Administration.—Croton oil may be given in emulsion, or mixed with some bland oil, or dropped on a piece of loaf sugar, or in pill form.

The best excipient for pills of croton oil is breadcrumb.

Elaterinum—Elaterini—Elaterin. U. S. P.

Origin.—A neutral principle obtained from *elaterin*, a substance deposited by the juice of the fruit of *Elæagnus angustifolia*, L., commonly known as *silver chesnut*, a tree growing in the Mediterranean region of Europe, Africa, and Asia.

Description and Properties.—Minute, white, translucent, platelike crystals, without odor, and having a slightly acrid, bitter taste. Permanent in the air; soluble in 4250 parts of water and 137 parts of alcohol.

Dose.— $\frac{1}{16}$ – $\frac{1}{8}$ grain (0.003–0.005 Gm.) ($\frac{1}{16}$ grain (0.003 Gm.), U. S. P.)

Official Preparation

Trituratio Elaterini Trituratio^{nis} Elaterini Trituration of Elaterin.—*Dose*, about $\frac{1}{16}$ grain (0.005 Gm.) ($\frac{1}{16}$ grain (0.005 Gm.), U. S. P.)

Physiological Action and Therapeutics.—Elaterin is the most powerful hydragogue purgative known.

The drug greatly increases the salivary, gastric and intestinal secretions, as well as those from the liver and pancreas.

It is a violent purgative, whether given internally or injected subcutaneously, producing abundant watery evacuations attended with much griping pain and great prostration.

Elaterin is indicated where profuse serous discharges are desired, as in cases of *congestion of the brain and lungs*, *ascites*, and *chronic nephritis*.

Contraindications.—The drug is not permissible in inflammatory conditions of the gastro-intestinal tract, nor in pregnancy, and it should be administered with much care, if at all, in *heart disease*.

Administration.—The drug in alcoholic solution, or in the form of capsules, is greatly in strength, which suggests

Cambōgia—Cambōgia

Origin.—A gum resin obtained from *Gambogia* tree, indigenous in Siam, Cambodia, and

Description and Properties.—In the center, 1 to 2 inches (2-5 Cm.) in diameter, fracture flattish-conchoidal, of a waxy lustre, odorless, taste very acid, the powder soluble in alcohol and ether. Cambogic acid is thought

Dose.—1-5 grains (0.06-0.32 Gm.), [2

Official Preparation

Pillule Cathartice Compositae—Pills of Compound Cathartic Pills.—**Dose.** 1-3 pills

Physiological Action and Therapeutic Uses.—A mild hydragogue purgative, exciting the secretion from the intestines, and augmenting the secretion of bile. It is also slightly diuretic, coloring the urine.

Gamboge is seldom given alone, but is combined with other purgatives. It is used in the treatment of the action by the kidneys, as well as in the treatment of the thought to be of use in hepatic diseases. The drug is an efficient cathartic, and is prescribed with vermicide medicine

DRASTIC PURGATIVES

These drugs are even harsher than the mild purgatives, exciting violent peristalsis, and causing gastro-enteritis and all the symptoms of severe purgation. The evacuations produced by them are watery, and attended with much mucus and borborygmi.

Colocynthis—Colocynthis

Origin.—The peeled, dried fruit of *Colocynthis* plant is indigenous in Japan, and is cultivated in India.

Description and Properties.—Fruit is globular, white or yellowish white, light, and is divided into 4-6 shaped pieces, each containing, near the center, a small seed, inodorous, taste intensely bitter.

The active constituent of colocynthis is colocythol, present about 2 per cent. Colocynthis also contains a small amount of resin.

Dose.—5-10 grains (0.3-0.6 Gm.) [1 g

Official Preparations

Extractum Colocynthis.—**Extracti Colocynthis.**—**Extract of Colocynth.**
Dose.—1/2 grain = 0.0315 (0.0013 grain 0.0001 troy) (U. S. P.)
Extractum Colocynthis Compositum.—**Extracti Colocynthis Compositi.**
Compound Extract of Colocynth.—1 extract of colocynth, 10 per cent., with a mix-
 ture of castor-oil, chloroform, and soap.
Dose.—5-25 grains (0.3-1.6 Gm.) [7½ grains (0.5 Gm.) (U. S. P.)]
 (Commercial extract of colocynth enters into the following pills.)
Pillule Cathartice Compositæ (5 per cent.)
Pillule Cathartice Vegetabiles (5 per cent.).

Physiological Action and Therapeutics.—The action of colo-
 cynth is very similar to that of elaterin. In small doses, however,
 it acts as a stomachic, improving the appetite and augmenting
 the secretions of the whole gastro-intestinal tract. Colocynth is a
 decided cholagogue.

Pills containing colocynth are useful to produce abundant
 watery evacuations, as is necessary sometimes in the treatment of
 hepatic and renal diseases where there is constipation and acutis.

The drug should be employed only when there is some marked
 indication for its use, as colocynth, like the other drastics, is too
 irritant for habitual use.

Gastro-intestinal inflammation, pregnancy, etc., would contra-
 indicate its use.

Jalāpa—Jalāpæ—Jalap. U. S. P.

Origin.—The dried tuberous root of *Euphorbia purga* (Wendl.) Bontham yield-
 ing not less than 5 per cent. of total resin, but not more than 1.5 per cent. of resin
 soluble in ether. Jalap is a twining herbaceous perennial, growing on damp and shady
 woods on the western slope of the Mexican Andes. It has been introduced into India
 and Java.

Description and Properties.—Napiform, periform, or clubbed, varying in
 size, the large roots twisted, more or less wrinkled, dark brown, with lighter-colored
 spots and short transverse ridges. Hard, compact internally, pale grayish brown, with
 numerous concentric circles composed of small rounded, fleshy tubercles, not
 fibrous, color light but peculiar, similar, and constant, taste sweetish and astringent.

Jalap contains two principles, *jalapin* and *emulsionin*, which are the active prin-
 ciples of the drug.

Dose.—5-30 grains (0.32-2 Gm.) [15 grains (1 Gm.) (U. S. P.)]

Official Preparations

Pulvis Jalapæ Compositus.—**Pulveris Jalapæ Compositi.**—**Compound Jalap**
Powder. 35 per cent., with potassium bitartrate. *Dose.*—15-30 grains (1-2 Gm.)
 [30 grains (2 Gm.) (U. S. P.)]

Resina Jalapæ.—**Resinæ Jalapæ.**—**Resin of Jalap.**—*Preparation and Properties.*
 A yellowish-brown or brown mass of irregular shape, breaking with a resinous glassy
 fracture, translucent at the edges, of a yellowish gray or yellowish brown powder,
 having a slight orange color and a somewhat astringent taste. Permanent in the air
 under its own weight in all proportions.

Dose.—1-4 grains (0.06-0.26 Gm.) [2 grains (0.126 Gm.) (U. S. P.)]

Extract of jalap is one of the ingredients of **Pillule Cathartice Compositæ** and
Pillule Cathartice Vegetabiles.

Physiological Action and Therapeutics.—The purgative
 action of jalap is developed in the duodenum, where it comes in

contact with the bile. The secretion is greatly augmented, as well as the flow in the intestines. The biliary flow is but slightly increased.

Purgation is produced by jalap, the evacuations being profuse and without pain.

Jalap—or, preferably, the compound hydragogue cathartic for the remission of dropsy—is especially appropriate for nephritic dropsy.

Small doses of jalap are sufficient to produce intestinal secretion.

The drug is frequently associated with castor oil as a vermifuge.

Scammōnium—Scammōr

Definition.—A gum resin obtained from *Scammōnia* L. Scammony is an herbaceous perennial growing in Minor Asia and Greece.

Description and Properties.—Circular cakes, greenish gray or blackish, with a resinous fracture, of a resinous luster, odor peculiar, acrid; powder gray or greenish gray.

It contains a glycoside, *jalapin*, white starch, etc.

Dose.—1–15 grains (0.06–1.0 Gm.) [4]

Official Preparation

Resina Scammōnii—Resina Scammōnii.—Yellowish brown or brown, with a glossy, resinous fracture, translucent; when powdered, having a faint, peculiar odor, soluble in alcohol in all proportions.

Dose.—1–8 grains (0.06–0.5 Gm.) [3 grs.]

Physiological Action and Therapeutics.—Scammony is identical with that of jalap, but its action is more muscular coat of the intestines, and is more griping than jalap, though not so violent as the latter drug.

The therapeutics are the same as those of jalap.

The drug may be given in powder or in pillular form, but is less inactive in pillular form.

Podophyllum—Podophylli

(MAY A)

Origin.—The dried rhizome and root of a perennial growing in rich woodlands of the United States.

Description and Properties.—Cylindrical, about 2 inches (5 Cm.) long, flattened, somewhat enlarged at the end, which has a small, nearly simple, fragile roots on the

laterally, smooth or somewhat wrinkled, orange brown, internally white and mealy, with a mass of small wood bundles, pith large, mealy inodorous, taste sweetish, somewhat bitter and acid.

Podophyllum contains a resin, *podophyllin*, composed principally of two anhydrous isomers, glycosides *podophyllotoxin* and *protopodophyllotoxin*. These represent the active principles, although attempts have been made to show that protopodophyllotoxin is included in the composition of the former glycoside. Among other constituents of the drug are several minor resins and a coloring principle.

Dose. 5-20 grains (0.33-1.29 gm.) (7½ grains (0.5 gm.), U. S. P.).

Official Preparations.

Fluidextractum Podophylli—**Fluidextracti Podophylli**—**Fluidextract of Podophyllum**. *℞* Podophyllum 100 g. (3.113 oz.) (U. S. P.).

Resina Podophylli—**Resinæ Podophylli**—**Resin of Podophyllum**. *℞* Podophyllum 100 g. (3.113 oz.) (U. S. P.).
Preparation.—A granular powder, varying in color from greenish white to pale greenish yellow or yellowish green, turning darker when exposed to heat, having a slight peculiar odor and a peculiar, faintly bitter taste, permanent in the air, soluble in a number of solvents.

Dose. 1 grain (0.065 gm.) (U. S. P.).

Pillule Podophylli, Belladonnæ et Capsici—**Pillule Podophylli, Belladonnæ et Capsici**—**Pills of Podophyllum, Belladonna and Capsicum**. *℞* Podophyllum 10 g. (0.311 gm.) (U. S. P.).
 Belladonna 10 g. (0.311 gm.) (U. S. P.).
 Capsicum 10 g. (0.311 gm.) (U. S. P.).
 Extract of belladonna leaves, and 1/2 grain (0.032 gm.) (U. S. P.).

Dose. Average dose 1 pill (U. S. P.).

Physiological Action and Therapeutics.—The powdered root is an irritant to the skin, and when inhaled occasions a decided irritation of the eyes and respiratory passages. It is absorbed when applied to ulcers and raw surfaces, producing its characteristic purgative effects. The drug is a gastro-intestinal irritant, being apt to excite nausea, in full doses producing salivation and greatly augmenting the intestinal secretions, and especially the bile. Under full doses of podophyllum there is marked peristalsis, attended with severe griping pains, and in the course of ten or twelve hours there is produced a complete evacuation of the bowels, the feces being liquid and deeply stained with bile.

The drug is thought to be an active hepatic stimulant and cholagogue, it is a particularly appropriate remedy in that condition known as *torpor of the liver*. The constipation attending hepatic *cirrhosis* and *cancer*, as well as that from any hepatic disorder, is well treated by podophyllum.

The slowness and completeness of its action, together with its property of stimulating the functional activity of the liver, renders the drug extremely serviceable in the treatment of *habitual constipation* from any cause.

It should, however, be associated with antispasmodics, such as hyoscyamus or belladonna, to overcome its griping. When associated with other purgatives care should be exercised to select those only which like itself, are tardy in their action.

Owing to the susceptibility of certain persons to the drug, the dosage should be small at first and gradually increased as necessary.

SALINE CA

**Liquor Magnēsii Citrātis—
—Solution of Magnes**

Formula: Dissolve magnesium carbonate
syrup of citric acid, 60; then crystals of p
and wire immediately. The product efferve

Dose.—2-8 fluidounces (60.0-237.0 C

**Magnēsii Sūlphas—Magn
sium Sulpha**

(Epsom

Origin.—Obtained by the action of su
bonate, treated with water, filtered, and the

Description and Properties.—Si
crystals, without odor, and having a coolin
cent in dry air. Soluble in 1.5 parts of w

Dose.— $\frac{1}{2}$ -1 ounce (8.0-32.0 Gm.) [

Antagonists and Incompati
compatible with alkaline carbona
lead acetate, silver nitrate, and lin

Synergists.—Saline purgative

**Magnēsii Sūlphas Effervi
tis Effervēscētis—
Sulphate. U. S. P.**

Magnesium sulphate, 500; sodium b
acid, 136

This may take the place of magnesi
has been dropped.

Dose.—Average dose: 240 grains (16

**Potāssii Sūlphas—Potās
Sulphate.**

Origin.—Prepared by adding potass

Description and Properties.—
rhombic prisms terminated by pyramids, c
somewhat bitter, saline taste. Permanent
water, insoluble in alcohol.

Dose.— $\frac{1}{2}$ -4 drams (2.0-16.0 Gm.) [

**Potāssii et Sōdii Tārtras--
—Potassium and Sodi**

(Rochel

Origin.—Prepared by adding acid p
carbonate

Description and Properties.—
white powder, odorless, and having a cool
vesce in dry air. Soluble in 1.4 parts of 1

Dose.—30 grains to 1 ounce (2.0-32

Official Preparation

Pulvis Effervescens Compositus—Pulveris Effervescentis Compositi—Compound Effervescent Powder (SÖDLITZ POWDER). Each powder has of Rochelle salt, 9j, of sodium bicarbonate, ʒi, mixed in a blue paper, and of tartaric acid, ʒj gritis, in a white paper.

Dose.—One or two of each dissolved separately in separate quantities of water, the solutions poured together and drunk while effervescing.

Södlî Phösphas—Södlî Phosphätis—Sodium Phosphate. U. S. P.

(SODIUM ORTHOPHOSPHATE.)

Origin.—Prepared by digesting bone ash with sulphuric acid. The solution is filtered, and to it is added sodium carbonate, and the filtrate evaporated to crystallization.

Description and Properties.—Large, colorless, monoclinic prisms, odorless, and having a cooling saline taste. The crystals effervesce with water, and gradually lose 5 molecules of water of crystallization. Soluble in 5 c parts of water; insoluble in alcohol. Sodium phosphate should be kept in well stoppered bottles, in a cool place.

Dose.—5 grains to 1 ounce. (ʒjʒ—ʒjʒ ʒ (Gm.) [30 grains (2 Gm.), U. S. P.]

Official Preparations.

Södlî Phösphas Exsiccatus, 15 grains (1 Gm.).

Södlî Pyrophosphas, 30 grains (2 Gm.).

Södlî Phösphas Effervescens, ʒi (3 Gm.).

Liquor Södlî Phosphatis Compositus, ʒi drams (8 c.), see all useful.

Södlî Sülphas—Södlî Sulphätis—Sodium Sulphate. U. S. P.

(GLAUBER'S SALT.)

Origin.—The residue left in the manufacture of hydrochloric acid from salt is treated with sodium carbonate.

Description and Properties.—Large colorless, transparent, monoclinic prisms or granular crystals, odorless, and having a bitter, saline taste. (The salt effervesces rapidly in the air and finally loses all its water of crystallization. Soluble in 2.5 parts of water and in glycerin; insoluble in alcohol.)

Dose.—1-8 drams (4.0—ʒjʒ ʒ (Gm.) [15 grains (1 Gm.), U. S. P.]

Physiological Action and Therapeutics of the Salines.—These preparations greatly augment the amount of fluid in the intestinal canal. This increase of fluid is not a secretion, but a result of the high osmotic equivalent of the salts, which tends to draw the body-fluids into the intestines, while hindering to a certain extent absorption of fluid from the intestines. The purgative influence is ready due to the mechanical action of the fluid in the intestines.

Save the sulphate and phosphate of sodium, the salines have little effect upon the biliary secretions.

The sodium salts are more efficient than the potassium salts as purgatives, owing to their higher osmotic equivalents.

Purgation by the salines is painless and occurs usually in from two to three hours after administration, there being ordinarily two or three watery evacuations.

In cases of *habitual constipation* with the *gouty diathesis*, there are no *OF SODIUM* or mineral waters contain *Marienbad*, *Hunyadi Janos*, *Apenta*,

For children there is no better *PHATE*, especially where the stools *duodenal catarrh* excellent results are in *chronic rheumatism*, and to retard

Concentrated saline purgatives removal of *dropsical* and *pleuritic eff*

MAGNESIUM SULPHATE, combined the most efficient treatment in cases

ROCHELLE SALT and SEIDLITZ P purgatives in cases of *biliousness*, *MAGNESIUM CITRATE* is used for the s palatable and acceptable to the s besides being apt to occasion slight

Administration.—The salines i as concentrated a solution as poss administered in the morning, when t

ANTHELMINTICS

Anthelmintics are remedies which Those drugs which kill the parasi those which simply promote their e There is little real distinction in the

The *vermicides* are :

Aspidium,
Chenopodium,
Cusso,
Granatum,

The *vermifuges* are :

Calomel,*
Hydragogue Purgatives,*

Anthelmintics are here divided a nal parasite against which they are

The *Oxyuris vermicularis* is a worm or threadworm, that infests The *Ascaris lumbricoides* is the com in the small intestine.

The *Tonæ* are the tapeworms.

Anchylostoma, or *Uncinaria*, is t important hook worms.

* Drugs marked with an asterisk (

Santoninum—Santonini

Definition.—The inner anhydride or *Santonica*.

Description and Properties.—Colorless, odorless, and nearly tasteless when first giving a bitter taste; not altered by exposure to light. Nearly insoluble in cold water; so should be kept in dark, amber-colored vials, etc.

Dose.— $\frac{1}{4}$ grain (0.016–0.05 Gm.) for an adult [$\frac{1}{2}$ grain (0.03 Gm.), U. S. P.].

Official Preparations

Trochisci Santonini—Trochiscos (see *Pharm.*)
—Each troche contains $\frac{1}{4}$ grain (0.03 Gm.).
Dose—2 (child) to 10 (adult, trochea).

Physiological Action and Therapeutic Uses.—Small doses santonin may excite nausea, pain, diarrhea, eructations, borborygmi; enters the blood, where it exists; large doses may cause giddiness, headache, taste, tremors, and a species of symptoms forming what is called *santoninism*.

The drug is chiefly eliminated in the urine. Small amounts of santonin even imparting a yellow color if the urine is acid, and a decoloration if the urine is alkaline. Under the action of santonin may produce so much yellow in the urine as to suggest hematuria.

Probably the most remarkable effect of medicinal doses of santonin is the production of vision, which may continue for several days. "There occasionally appears before the eyes, after large doses of santonin, a violet color, the intensity of this color is in proportion to the amount looked at. All light objects, such as white paper, actually yellow. Red and blue appear orange, orange and green, so that clouds appear a bronze color, and the sky appears blue; however, is not always the case, as in the employment of santonin that red and blue objects appear orange to one person and blue to another" (Quoted from Lewin.) This peculiar effect, according to Rose, to a nervous character.

Affections of the skin—e. g., urticaria, etc., followed the administration of santonin. Convulsions have sometimes been produced by the drug. The symptoms of a fatal case were convulsions accompanied by

eyeballs, dilated pupils, cold sweat, weak pulse, feeble respiration, and, after some hours, sudden death.

In case of poisoning by santonin the remedial measures are internal and external stimulants, eliminants, and artificial respiration. Santonin is certainly a most efficient remedy against the *ascaris*, and to a less extent it is of use against the *oxyuris*. It has no effect on the *lunula*.

The drug should be given on an empty stomach, preferably at night, either alone or associated with calomel, and followed in two or three hours by castor oil or other brisk cathartic. It may be administered in the form of a powder mixed with sugar or jelly, or in pills or capsules. Troches of santonin are much used and are very efficient. Care should be taken that they are fresh and that they should not be permitted to remain a great length of time in the intestine.

Spigelia—Spigellæ—Spigelia. U. S. P.

(PINK ROOT.)

Origin.—The dried rhizome and roots of *Spigelia maritima*, L., a plant growing in rocky woods, chiefly in the southern part of the United States, but found as far north as Pennsylvania and Wisconsin.

Description and Properties.—Of horizontal growth, about 2 inches (5 centim.) in length, root 1 mill. (3 Min.) thick, dark purple beneath, somewhat flattened on the upper side, with cup-shaped scars on the lower side with numerous thin, white, light-colored roots about 4 millim. (1/16 in.) long, the rhizome externally with a whitish wood and a pith which is usually dark colored or decayed, of a more or less aromatic, taste sweet at first, and purgative.

It contains a volatile oil, which is thought to be the active principle.

Dose.— $\frac{1}{2}$ - 2 drams (1.5 - 3.0 Gm.) [60 grains (4 Gm.), U. S. P.]

Official Preparation.

Fluidextractum Spigellæ. **Fluidextracti Spigellæ.** **Fluidextract of Spigelia.**—Dose, $\frac{1}{2}$ - 2 fluidrams (1.5 - 3.0 Cc.) [1 dram (4 Cc.), U. S. P.]

Physiological Action and Therapeutics.—*Spigelia* is a powerful anthelmintic, being a decided vermifuge against the *Ascaris lumbricoides*. When given alone and in full doses it may produce symptoms of narcotic poisoning. The symptoms are those of depression of the respiration with convulsive seizures and occasionally temporary blindness. This may be obviated by associating it with cathartics and aromatics.

The drug may be administered in the form of a tea, associated with senna, fennel, or other aromatics. The fluidextract is a reliable preparation.

Aspidium—Aspidii—Aspidium. U. S. P.

(MALE FERN.)

Origin.—The dried rhizome of *Aspidium ad-nigrum*, L., or of *Aspidium filix-mas*, L., a fern, indigenous in North America, a portion of South America, Asia, Europe, and some parts of Africa.

Description and Properties—In larders, pills, or compressed clusters consisting of particles united so as to form a mass, with a checkered surface. The base of each larder, the two faces, presents a fine rose of carnation and the surface is white, smooth, and free of all blemishes, the edges are sharp, and the shape is larder, enclosing two opposite surfaces, color light, fragrant, and the taste is bitter, acid, and astringent.

It contains an active principle, koussoin, a tannic acid and an acid resin, and a sugar.

Dose—1-4 drams (40-160 Gm.) (240 grains, 16 Gm., U. S. P.)

Physiological Action and Therapeutics—The action of koussoin upon the digestive tract, under large doses, is similar to the action of aspidium. It is a reliable anthelmintic for all species of tapeworm. The fluidextract should be given in the form of an emulsion, the patient having previously fasted, and the exhibition of the drug followed in a few hours by a large dose of castor oil. Nausea, vomiting, diarrhoea, and collapse may develop after large doses.

Granatum—Granātl—Pomegranate. U. S. P.

Origin—The bark of the tree and fruit of *Punica granatum* L., a shrubby small tree 20 feet (6 M.) high, and grown in Southwestern Asia from Northern India to Persia.

Description and Properties—In thin, pulpy or fragmentary form 2 to 4 inches (5 to 10 cm.) and from 1/4 to 1/2 inch (1 to 1 1/2 Mm.) thick, outer surface reddish gray, somewhat warty or granular, and the inner surface of the bark is white, partly covered with a thin, white, the inner part of the bark is more or less white, externally more or less smooth, thin, and grayish white, the bark is granular, greenish yellow, indistinctly radiate, translucent, taste astringent, very slightly bitter.

It contains as its active constituent a red alkaloid, punicic acid, with its three allied principles, puniceic acid, puniceic acid, and puniceic acid, besides tannic acid and sugar.

Dose—1/2-1 1/2 drams (20-60 Gm.) (30 grains (2 Gm.), U. S. P.)

Preparations.

Pelletierina Tannas Pelletierina Tannatis Pelletierina Tannata U. S. P. *Tannas*—A mixture of tannic acid and punicic acid, the former being in excess. (punicic acid, methylester, methylester, and punicic acid) obtained from *Punica granatum*, punicic acid.

Tannatis—A mixture of tannic acid and punicic acid, the former being in excess. (punicic acid, methylester, methylester, and punicic acid) obtained from *Punica granatum*, punicic acid.

Tannata—A mixture of tannic acid and punicic acid, the former being in excess. (punicic acid, methylester, methylester, and punicic acid) obtained from *Punica granatum*, punicic acid.

Dose—Average dose 4 grains (25 Gm.) (25 Mg., U. S. P.)

The punicic acid is a white, crystalline substance, soluble in water, and in alcohol. While the U. S. P. has a punicic acid, the average dose is 4 grains (25 Gm.) (25 Mg.), which is a mixture of 10 grains (25 Gm.) (25 Mg.) of punicic acid and 15 grains (25 Gm.) (25 Mg.) of tannic acid. Very small quantities of punicic acid have been found in the bark of the tree.

Fluidextractum Granati Fluidextractum Granati U. S. P. *Fluidextractum Granati*—A fluidextract of the bark of the tree, prepared by the use of alcohol, and containing a small quantity of tannic acid. A mixture of tannic acid and punicic acid, the former being in excess. (punicic acid, methylester, methylester, and punicic acid) obtained from *Punica granatum*, punicic acid.

Dose—Average dose 30 minims (2 Cc., U. S. P.)

Physiological Action and Therapeutics.—The fruit is astringent. In large doses it is purgative, paralyzes the motor nervous system, and dilates the capillaries.

Poisonous symptoms usually begin with chilliness, chilly sensations, and rise in temperature, and collapse, with nausea and vomiting, to occur and to persist for some time.

Pomegranate and its alkaloid, punicic acid, are sometimes used as minims for tapeworm.

Like other anthelmintics, the drug acts on the stomach, and if the bowels are not active a cathartic should follow its action.

A decoction of the bark may be used in obtaining the fresh drug, but in its mintic properties, the tannate of iron is usually administered.

Pêpo—Pepōnis—Pumpkin Seed

Origin.—The ripe seed of *Cucurbita pepo* is found in tropical Asia and America, and cultivated in the West Indies.

Description and Properties.—The seed is flat, white or whitish, nearly smooth, with a short, conical radicle and two flat, oblong, winged seeds. It contains an *acid resin*, supposed to be 35 per cent. of a thick red fixed oil.

Dose.—1-3 ounces (32.0-94.0 Gm.) [1 ounce = 28.35 Gm.]

Physiological Action and Therapeutics.—The seed is next to aspidium in the minds of the ancients for the destruction of *tapeworm*, a free from any disagreeable taste or odor. For the preparation the fresh pumpkin seeds are washed with powdered sugar and diluted with water (500 Cc.). Previous to its administration the patient is fast for twenty-four hours, when the decoction is taken as a large saline purgative. A portion of the seed is then to be taken, preferably taken in two doses at intervals of four hours, meanwhile remaining in bed to prevent any exertion of the stomach.

DRUGS ACTING ON THE RESPIRATORY MUCOUS MEMBRANES.

EXPECTORANTS.

EXPECTORANTS are drugs which stimulate, depress, or modify the secretion from the bronchial or laryngeal mucous membranes and promote its expulsion.

There are many drugs not classed as expectorants which, under certain conditions, may be used to serve one of these purposes. Thus, opium and chloral, by the depressing influence which they exert upon the respiratory center and the reflex mechanism, may relieve reflex and purposeless cough, or, as is the case with the former drug, check excessive secretion or render it more viscid.

Demulcents, such as gum acacia, flaxseed elm, etc., and other drugs like potassium chlorate, sodium chloride, etc., either lessen or excite the tracheal and bronchial cilia, retarding or promoting expectoration of bronchial mucus. The classification usually adopted seems to be the most reasonable—viz., that of dividing expectorants into two classes: 1. Nauseant or Sedative; 2. Stimulating. Among the more important Nauseant or Sedative Expectorants¹ are:

- | | |
|--|---------------------|
| • Alkalies; | • Ipecacuanha; |
| • Antimony and potassium tartrate (tartar emetic); | • Lobelia; |
| • Apomorphine, | • Phloecarpus, |
| Grindelia, | • Potassium iodide; |
| | • Quinchacho, |

all of which are considered in detail elsewhere.

The important Stimulating Expectorants are:

- | | |
|--|-----------------------------|
| • Acids; | • Oleum pinu pumilionis; |
| • Ammonium carbonate; | • Onion, |
| Ammonium chloride; | • Saccharine substances; |
| • Balsam of Peru; | Sanguinaria, |
| • Balsam of Tolu; | • Senega (saponin), |
| • Benzoin and benzoic acid, | • Sulphur; |
| • Copaiba, | • Squill; |
| • Cubebs, | • Tar; |
| • Garlic, | • Terebene; |
| Licorice, | • Terpin hydrate; |
| • Nux vomica | • Turpentine, |
| Strychnine), | • Volatile oils in general. |
| • Oil of Scotch fir (oleum pinu sylvestris), | |

¹ (Those marked with an asterisk (*) are elsewhere given in detail.)

As a rule, Sedative Expectorants are used in the early stages of bronchitis, when, as in the case of catarrhal inflammations, there is a diminution of function, absence of secretion, and the cough is often with distressing, harsh, and dry cough.

In these conditions of the respiratory tract, sedative expectorants serve a useful purpose by relaxing the bronchial tension, lessening the blood-supply to the inflamed parts, and increasing the secretion of mucus.

In sufficiently large doses to produce vomiting, emetics are frequently employed to clear the airway mechanically by the act of vomiting.

Stimulating expectorants are used in the later stages of relaxed conditions of the mucous membranes. They are employed to diminish or disinfect the inflamed parts. These remedies generally irritate the mucous membrane, induce expectoration, being eliminated by the mucous membranes which they irritate.

The alkalies are especially useful in the later stages of mucus, rendering it more fluid, less tenacious, and easily expelled.

It requires considerable skill to select the remedy that best suits the various conditions of the respiratory passages. In the early stages of them it is often difficult to decide whether to give a sedative or a stimulant. The practitioner should carefully examine each individual case, and decide whether he wishes to diminish or increase the secretion of the respiratory tract; to stimulate or depress the action of the spasm of the bronchial muscles; to increase or diminish the bronchial secretion.

A thorough knowledge of the physiological action of the various remedies is necessary to enable the observant practitioner to select the most proper manner as to yield ordinarily high results.

Ammōnii Chlōridum—Ammonium Chloride

Origin.—Ammonium sulphate is heated with sulphuric acid. After crystallization sal ammoniac is obtained.

Description and Properties.—A white, crystalline powder, having a cooling, saline taste, and permanent in water, almost insoluble in alcohol.

Dose.—1-30 grains (0.06-2.0 Gm.)

Official Preparation

Trochisci Ammōnii Chlōridi—Troches of Ammonium Chloride.—Lac. Amm. 100, Troch. 100.

Antagonists and Incompatibles — Therapeutically, ammonium chloride is antagonized by the cardiac depressants. The incompatibles are—alkalies, alkaline earths and their carbonates, tartaric acid, mineral acids, and the soluble lead and silver salts.

Synergists.—The expectorants, emetics, and diaphoretics enhance the action of the drug.

Physiological Action—*Externally and Locally*—Ammonium chloride is an irritant.

Internally—In medicinal doses the drug increases the secretions from the gastro-intestinal glands. Ammonium chloride is readily absorbed, and is eliminated by the kidneys, skin, bronchi, and mucous membranes generally, the drug being a feeble diuretic, diaphoretic, and expectorant.

Save uric acid, which is slightly diminished all the solids of the urine are increased under the use of ammonium chloride. The drug is not considered poisonous.

Therapeutics—*Externally and Locally*—AMMONIUM CHLORIDE possesses a wide range of therapeutic applications. Solutions of various strengths have proved markedly efficient as local applications in *indolent buboes*, *epididymitis*, *orchitis*, *bruises*, *inflammatory swellings*, *suppurative mastitis*, etc. *Scirrhous cancer* is much benefited by immersing the foot in a bath containing 8 ounces (249.0 Gm.) of the drug to 1 gallon of water.

A solution of 3 drams (12.0 Gm.) of ammonium chloride to 1 pint (473.17 Cc.) of water is an effluent remedy in *varicella*. The lotion may be used as an injection or a tampon saturated with the fluid and applied to the parts.

LOZINGES, SOLUTIONS, or the NASCENT FORMS of the drug have been found serviceable in many diseases of the *nose*, *throat*, and *ear*, such as *coryza*, *chronic laryngitis* and *pharyngitis*, *chronic nasal catarrh*, etc.

Internally—Few remedies are more efficient than AMMONIUM CHLORIDE in *bronchitis* that has passed its inflammatory stage. In *chronic bronchitis*, particularly that form occurring in old people and persons of a feeble habit of body, the drug is very valuable, either given alone or associated with stimulant expectorants. The remedy has appeared to be somewhat beneficial in *asthma*.

Contraindications—Inflammation of the stomach, aggravated dyspepsia, marked emaciation, and anemia contraindicate the drug.

Administration—Ammonium chloride is best given in solution, its disagreeable taste being well disguised by the addition of some preparation of licorice, such as the syrup, the extract, or the aromatic elixir of licorice. In bronchial diseases the virtues of the drug are enhanced by this association.

Glycyrrhiza—Glycyrrhizæ—Glycyrrhiza. U. S. P.

(Licorice Root)

Origin—The dried root of *Glycyrrhiza glabra* L., one of the *Glycyrrhiza* species. (Wanderer in Kew etc.), a perennial plant growing in the eastern part of

the northern and southern shores of the Caucasus, Northern Persia, Afghanistan, and to some extent in England, France, Germany.

Description and Properties.—(6-25 Mm.) thick, longitudinally wrinkled, tawny yellow, pliable, tough, fracture porous, but dense in the narrow wedges, resinous. The underground stem, which is 1-2 cm. in diameter, contains a thin path.

The drug derived from the *G. glauca* is usually of roots or root branches 1-4 inches (2.5-10 cm.) long, frequently deprived of the cork more or less cleft.

Liquorice contains a glycoside, *glycyrrhizin*, and resin, starch, gum, etc.

Dose.—15-60 grains (1-4 Gm.) [30 g.

Official Preparations

Fluidextractum Glycyrrhizæ.—Fluid Glycyrrhiza. *Dose*, 15-30 minims (1.0-4.0 ml.).

Extractum Glycyrrhizæ.—Extract of Glycyrrhiza. *Dose*, freely. (Extract of glycyrrhiza is 0.5 g. trochiscus glycyrrhizæ et opii.)

Extractum Glycyrrhizæ Purum.—Pure Extract of Glycyrrhiza. *Dose*, freely.

Glycyrrhizinum Ammoniatum.—Glycyrrhizin. *Description and Properties.*—A white, crystalline powder, odorless and having a very sweet taste; re-

Dose, 5-15 grains (0.3-1.0 Gm.) [4 g.

Mistura Glycyrrhizæ Composita.—Compound Mixture of Glycyrrhiza (Brown). Glycyrrhiza, 30; syrup, 50; aconia, 30; camphor, 60; spirit of nitrous ether, 30.

Dose, 1-4 fluidrams (4.0-15.0 Gm.) [2

Pulvis Glycyrrhizæ Compositus.—Compound Powder of Glycyrrhiza. (See *See*

Besides the foregoing compound, there are eleven other official preparations.

Physiological Action and Uses.—Glycyrrhiza, when chewed, increases the flow of saliva and possesses slight stimulating properties. It favors the secretions of the corresponding passages.

LIQUORICE is used chiefly for its demulcent action in *throat, hoarseness, pharyngeal cough*, etc. Its general action. It is nothing new, but, being so frequently combined with other drugs, has acquired a vicarious reputation as a remedy. A mixture is a very efficient remedy.

The various preparations of liquorice are used for giving the taste of nauseous and bitter drugs for pills.

Administration.—There are many preparations of liquorice, and any of the preparations may be used.

Sēnega—Sēnegæ—Senega. U. S. P.

Origin—The dried root of *Polypodium Senega* L., a plant indigenous to North America, from Canada southward to South Carolina and westward to Wisconsin.

Description and Properties—About 4 inches (10 cm.) long, with a knobby crown and spread g. tortuous branches, pitted when dry, fleshy and round after having been soaked in water. External yellowish gray or brownish yellow, bark thick, white within, enclosing an irregular, porous, yellowish wood (pith), unobscured, taste sweetish, afterward astringent. Senega contains *senega*, also known as *capsarin*, an acid principle to which the medicinal property of the drug is due, besides a fixed and a volatile oil.

Dose.—10-30 grains (0.6-2.0 Gm.) [15 grains (1 Gm.) U. S. P.].

Official Preparations.

Fluidextractum Sēnegæ *Fluidextracti Sēnegæ* *Fluidextract of Senega*—*Dose*, 10-30 minims (0.5-2.0 cc.) [15 minims (1 cc.) U. S. P.].

Syrupus Sēnegæ *Syrupa Sēnegæ* *Syrup of Senega* (20 per cent. of fluid extract).

Dose, 30-60 minims (2.0-4.0 cc.) [1 fluidram (4 cc.) U. S. P.].

Syrupus Scillæ Compositus *Syrupi Scillæ Compositi* *Compound Syrup of Squill* contains 5 per cent. of senega. (Described under *Scilla*.)

Physiological Action—*Externally and Locally*—The active principle of senega is a decided irritant to the skin and mucous membranes, causing violent sneezing and cough, with marked hyperemia and increased secretion from the bronchial and nasal mucous membranes when the powder is inhaled.

Internally—Digestive System—Small doses stimulate the mucous membranes of the mouth and stomach, augmenting the salivary and gastric secretions, although frequently occasioning indigestion. Large doses irritate the alimentary canal, producing vomiting, diarrhea, and abdominal pain.

Circulatory System—Small doses have little action.

Nervous System—Under medicinal doses no important action has been noted.

Respiratory System—Excretion of the drug through the bronchial mucous membrane irritates the respiratory passages, occasioning hyperemia, increased secretion, and reflexly, cough.

Excretion and Elimination—The active principle of senega is absorbed with difficulty, being excreted through the bronchial mucous membrane and the kidneys, irritating these structures during the process, and consequently acting as a stimulant expectorant, and diuretic. The drug also possesses some diaphoretic virtue, being partially excreted by the skin.

Unfavorable Action—Immoderate, and in certain susceptible subjects small, doses of senega have produced irritation and burning in the throat, saturation, impaired appetite, a sense of oppression in the stomach, nausea, vomiting, colicky pains, and profuse diarrhea.

Poisoning—Senega is not regarded as a poisonous drug; excessive doses producing symptoms analogous to those of "Unfavorable Action," save that they are intensified. It should be remembered, however, that sapogenin and sapotoxin which are found in senega, as also is caryophyllin, quercetin, camphylol, and dulcamara are very

active blood poisons and may cause saponins are common, moreover, responsible for poisoning from unripe and egg-plant.

Treatment of Poisoning.—Eliminate symptoms treated as they appear, cardiac stimulants being employed.

Therapeutics.—*Externally* as observed.

Internally.—The principal use is as an expectorant. It is highly beneficial, power to cough is feeble. In like cases of *chronic bronchitis* and *chronic catarrh* less valuable when the mucus is thick.

The simple *catarrhal laryngitis* is relieved by the administration of senega.

The drug is an appropriate remedy for passive uterine congestion, and serves as a remedy for *uterine hemorrhage*.

Contraindications.—Senega is contraindicated in cases of indigestion, or when there is irritation of the gastro-intestinal tract.

Administration.—The syrup is employed as an expectorant. Senega grains (0.13 Gm.) in capsules.

Sanguinaria—Sanguinaria

(Blood-root)

Origin.—The dried rhizome of *Sanguinaria* native of Canada and the United States, where the rhizome should be collected in autumn.

Description and Properties.—The rhizome is 1 (m.) long and $\frac{1}{2}$ inch (1 m.) thick, cylindrical, wrinkled, reddish-brown; fracture short, small red tessellated, or of a nearly uniform slight, taste persistently bitter and acrid. *Microscopic.*—Yielding red salts; chelerythine, yields and protoxanthone.

These alkaloids are closely related to the

Dose.—2 to 20 grains (0.12-1.2 Gm.) (10 per cent.)

Official Preparations

Fluidextractum Sanguinariae.—Fluid Sanguinaria. *Dose.* 5-15 minims (0.3-1.2 cc.)

Tinctura Sanguinariae.—Tincture of Sanguinaria. *Dose.* 10-60 minims (0.6-4.0 cc.)

Physiological Action.—*Externally* an irritant and a feeble escharotic. If inhaled it produces great irritation with excessive secretion and violent

Internally—Digestive System—Medicinal doses occasion a sense of constriction in the throat and heat in the epigastrium, increasing the secretions from the stomach, liver, and intestines. Excessive doses are followed by marked salivation, nausea, and vomiting, the drug acting as a systemic emetic. Very large doses cause great irritation of the intestines, producing hypercatharsis.

Circulatory System—At first the heart's action is increased and arterial tension raised, but these effects are followed by cardiac and circulatory depression. Poisonous doses sometimes result in cardiac paralysis.

Nervous System—Large doses diminish reflex excitability by paralysis of the spinal centers, occasionally producing convulsions of spinal origin, resembling those caused by thecurium.

Respiratory System—Medicinal doses of sanguinaria have no apparent effect upon the respiration, poisonous doses, however, render the breathing slow and shallow, death resulting from asphyxia due to paralysis of the respiratory center. The final collapse is often preceded by convulsions arising from the accumulation of carbon dioxide in the blood from failure of respiration.

Blood-root is a stimulant expectorant, increasing the secretion from the bronchopulmonary mucous membrane.

Poisoning—Blood-root is an acrid narcotic poison, exciting salivation, violent vomiting, profuse watery evacuations from the bowels, and producing all the symptoms of gastro-enteritis. The muscular system is greatly relaxed, the pulse is slow, weak, and irregular, the skin covered with cold sweat, and finally, collapse of the vital powers supervenes. Convulsions may precede a fatal termination, which is due to paralysis of the respiratory or cardiac center.

Treatment of Poisoning—The stomach should be washed out and diffusible stimulants freely given. Strychnine may be administered hypodermically, and digitalis and amyl nitrite given if necessary. The pain and nausea may be relieved by morphine and atropine. The normal temperature of the body should be maintained by external warmth.

This drug is now seldom used locally the irritation caused by it being so great that patients can only with great difficulty be persuaded to submit to the treatment.

Internally—While possessing alterative properties and classed among the specifics, one of the principal uses of sanguinaria is in *acute dysentery*, when the spasmodic element predominates and after the subsidence of the more acute symptoms.

In atonic conditions of the *stomach* and *bowels*, with increased secretion of mucus, small doses of tincture of sanguinaria prove beneficial. The tincture is of equal value in *duodenal catarrh* with jaundice.

As an emmenagogue and aphrodisiac blood-root has been successfully employed in *functional amenorrhoea* and *dysmenorrhoea*, as

well as in functional impotence with and daily seminal losses.

Contraindications.—No special contraindications, except that it be an acute inflammatory condition.

Sanguinaria has practically gone out of use, and "old fashioned" a drug.

Balsamum Tolutanum—Balsam of Tolu.

Origin.—A balsam obtained from *T. peruviana* from 60 to 80 feet (18-24 M. high, growing in Mexico and New Granada.

Description and Properties.—A thick, yellowish mass, becoming more brittle when exposed to air, with an agreeable odor, recalling that of vanilla, taste ; readily and completely soluble in alcohol and alkalis ; almost wholly soluble in ether, and disulphide.

The drug contains a volatile oil (chiefly cinnamyl) and a resin.

Dose.—8-30 minims (0.5-2.0 Cc.) [15]

Official Preparations

Syrupus Tolutanus—**Syrupus Tolutanus**
2-6 fluidrams (80-240 Cc.) [4 fluidrams (120 Cc.)]

Tinctura Tolutana—**Tinctura Tolutana**
Dose, 1/2-2 fluidrams (20-80 Cc.) [30 minims (1.5 Cc.)]

Tinctura Benzoini Composita—**Tinctura Benzoini Composita**
Tincture of Benzoin (4 per cent.).—Description

Antagonists and Incompatibles.—Balsam of Tolu is pharmaceutically incompatible with strong acids and alkalies.

Synergists.—The balsams, and the volatile oils, are synergistic with stimulant expectorants.

Physiological Action.—Balsam of Tolu is a stimulant and expectorant when applied to the respiratory tract. It is a pleasant carminative and stomachic.

The drug is excreted principally in the urine, and secretions from which it stimulates the kidneys also share in the excretory process.

Therapeutics.—Inhalations of the vapor of balsam of Tolu are successfully employed in the treatment of bronchitis. A pigment composed of 1 part of balsam of Tolu to 10 parts of starch has been beneficially applied to the throat and pharynx.

Its agreeable flavor, together with its expectorant properties, renders tolu an important ingredient of cough mixtures, lozenges, vapor inhalants, and a course of subacute and chronic bronchitis.

Administration.—Tolu is usually given in syrup, although the tincture may be given. Inhalations of tolu vapor are employed, and are frequently used.

Pix Liquida—Piceis Liquidæ—Tar. U. S. P.

Definition.—A product obtained by the destructive distillation of the wood of *Pinus ponderosa*, *Mill.*, and other species of *Pinus*.

Description and Properties. Thick, viscid semisolid blackish brown, heavier than water, transparent in thin layers, becoming granular and opaque with age, insoluble in water, less soluble in alcohol, taste sharp, empyreumatic. Tar is soluble in water, soluble in alcohol, fixed and volatile oils, and solution of potassium or sodium hydrate.

The drug contains many substances, chief among which are creosote, volatile oil, pyrolic acid, acetone, and many resins, resins, gums, etc., pyrolic acid, pyrolic acid, acetone, and many resins, resins, gums, etc., pyrolic acid, pyrolic acid, acetone, and many resins, resins, gums, etc.

Dose.—15–60 grains (1.0–4.0 gm.) (7½ grains (0.5 gm.), U. S. P.).

Official Preparations.

Syrupus Piceis Liquidæ—Syrupi Piceis Liquidæ—Syrup of Tar (0.5 per cent.) — *Dose*, 1–4 fluidrams (4.0–16.0 cc.) (1 dram (4.0 cc.), U. S. P.).
Unguentum Piceis Liquidæ—Unguenti Piceis Liquidæ—Tar Ointment (50 per cent.) — Used externally.

Oleum Piceis Liquidæ—Olei Piceis Liquidæ—Oil of Tar (U. S. P.) — *Origin* — A volatile oil distilled from tar.

Description and Properties. — An almost colorless liquid when freshly distilled, but soon acquiring a dark reddish brown color, and having a strong tarry odor and taste. It is insoluble in water.

Dose.—1–5 minims (0.05–0.3 cc.) (3 minims (0.2 cc.), U. S. P.).

Derivatives and Allied Drugs

Picrol. — A compound of tar soap and caustic potash or soda. Used as a disinfectant and antiseptic.

Pice Balaule—Piceis Balaule—Birch Tar (Russian Resin) — *Origin* — Prepared in Russia from the wood and bark of *Betula alba*.

Description and Properties. Resembling wood tar in a measure, but becoming liquid, and having the peculiar penetrating odor of Russian leather, in the manufacture of which it is used. For the most part employed externally.

Oleum Cedrinum—Olei Cedrinæ—Oil of Cedar (U. S. P.) — *Origin* — A product of the destructive distillation of the wood of *Juniperus Cedrus*.

Description and Properties. — An empyreumatic brownish or dark brown clear thick liquid, possessing a tarry odor and an empyreumatic burning, somewhat bitter taste. A small amount in water produces a turbid emulsion.

Dose.—2–6 minims (0.12–0.3 cc.) — Usually used externally.

Antagonists and Incompatibles.—There are none of special importance.

Synonyms.—The aromatics, carbolic acid, creosote, and many of the antiseptics, turpentine, and the stimulant expectorants.

Physiological Action.—*Externally and Locally.*—Tar is a stimulant, astringent, antipruritic, antiseptic, and parasiticide. It is readily absorbed from the skin, and when applied too freely may produce a papular eruption.

Internally.—The action of tar closely resembles that of turpentine, although creosote is perhaps a more perfect analogue. Small doses stimulate the circulation and increase secretions generally. Immoderate dosage or the prolonged administration of tar impairs the appetite, deranges digestion, and depresses the circulatory and nervous systems.

While the drug is not considered poisonous, the ingestion of excessive quantities of oil of tar has been attended with fatal results.

The symptoms following imprudent use are severe abdominal pain, diarrhea, and the urine is colored blackish-brown, and emits the peculiar odor of tar. The face or the skin may be covered with eruptions, or intense itching.

Therapeutics.—*Externally* an exception of sulphur and mercury is made. Tar is an employed remedy for cutaneous diseases. It held an important place at one time in the treatment of *diseases of the nipples, boils, excoriations*, etc.

In *chronic eczema* the drug is proved beneficial in *chronic psoriasis*.

The OIL OF CADE and OIL OF TAR, being supposed as tar, being preferred by some. Tar preparations are valuable in *pruritus* and various itching diseases. It has a tendency to produce irritative and inflammation if continuously and injudiciously applied.

The benign and emollient effect of the drug is mixed with some soot, as chalk.

The valuable properties of tar in the treatment of diseases are often nullified by the lack of proper administration of it. Hyde has truthfully observed that he was entrusted with the management of many cases, but he can only be measured by his success in the treatment of them.

LOZENGES containing tar, the most common, containing tar are extensively employed in the treatment of *diseases of the nose and throat*.

Internally.—TAR has long been considered a remedy for chronic pulmonary diseases. In the treatment of *chronic bronchitis*, *obstinate acute bronchitis*, lessening the oppression and distress in the chest, and the symptoms, which attend many cases, are frequently relieved by some preparation of tar.

Not only is this remedy of value in the treatment of the respiratory passages; it is equally valuable in the treatment of the mucous membranes elsewhere.

It is employed with great benefit in *glaucos*, and being given both by the mouth and by the rectum.

Administration.—Tar may be given in the form of a lozenge, although the most palatable form is in the form of wine, and tar water, the last of which is of 1 or 2 pints (473.17 or 946.35 C

Terebēnum—Terebēni—Terebene. U. S. P.

Definition.—A liquid consisting chiefly of diterpene and other hydrocarbons, obtained by the action of concentrated sulphuric acid on oil of turpentine and subsequent rectification with them.

Description and Properties.—A colorless or slightly yellowish, thin liquid having rather an agreeable thyme-like odor and an aromatic, somewhat turpentine-like taste. Only slightly soluble in water, but soluble in an equal volume of alcohol. Terebene should be kept in well stoppered bottles, in a cool place protected from light.

Dose.—5-15 minims (0.3-1.0 Cc.) [8 minims (0.5 Cc.) U. S. P.]

Physiological Action.—When applied externally terebene acts as a stimulant, germicide, antiseptic, and astringent. Internally, small doses act as a stimulant to the gastro-intestinal tract, large amounts being irritant and producing effects similar to those of turpentine.

The drug is eliminated by the kidneys, bronchial mucous membranes, skin, bowels, etc., acting as a mild astringent and antiseptic at the points of elimination.

Therapeutics.—*Externally and Locally.*—The inhalation of terebene—20 minims (1.25 Cc.) daily—alleviates the cough of *laryngeal phthisis* and has proved beneficial in irritative *bronchial cough*, while a spray of terebene mixed with oil of eucalyptus and alcohol has been advised in *whooping-cough*.

Internally.—Whether inhaled or taken into the stomach, terebene is a powerful stimulant, antiseptic expectorant in *chronic bronchitis*.

The drug is of service in affections of either the upper or lower respiratory passages. In *winter-cough*, *bronchitis*, *emphysema*, and even in *phthisis*, it is an efficient remedy.

Not only in bronchial affections is the drug valuable but it has been used with striking success as a substitute for copaiba and oil of sandalwood in *genito-urinary diseases*. It has even been claimed to influence favorably the course of *puerperal fever* and to relieve the symptoms of *flatulent dyspepsia*.

Administration.—Terebene may be given in emulsion or in mixtures associated with other expectorants and enclosed in capsules or dropped upon sugar.

Terpini Hydras Terpini Hydrātis—Terpin Hydrate. U. S. P.

Origin. The hydrate of the diuretic alcohol terpin, prepared by heating rectified oil of turpentine, washed and freed from the resin, to a rapid boil, and then adding to this a portion of water, allowing the mixture to cool, and filtering on a slanting plate, and recrystallizing the residue which has formed.

Description and Properties.—A white, crystalline, rhombic, prismatic crystals, and having a slightly aromatic and somewhat resinous odor. Terpin hydrate is soluble in about 10 parts of water and in 10 parts of alcohol. Terpin hydrate should be kept in well stoppered bottles.

Dose.—2-30 grains (0.13-2.0 Gm.) [2 grains (0.125 Gm.) U. S. P.]

Physiological Action.—Terpin hydrate is a powerful antiseptic, its action resembling that of turpentine, though inferior in strength.

Therapeutics.—*Externally and Locally.*—The drug is used in the form of lozenges and as an inhalant in *chronic tracheitis* and *chronic bronchitis*.

Internally.—Terpin hydrate may be used for the same purposes as terebene, being considered by some physicians superior to the latter drug in bronchial affections.

Administration.—Terpin hydrate may be given in lozenges, emulsion, or aromatic elixir, although the most judicious method of administration, perhaps, is in capsules.

Allied Compound.

Terpinol is obtained by boiling terpin hydrate with dilute mineral acids. It occurs as an oily body with a hyacinthine odor. Insoluble in water, but readily soluble in alcohol and in ether.

Terpinol is a valuable bronchial stimulant, and may be used for the same diseases of the respiratory passages for which terpin hydrate is recommended.

It is best given in capsules, in doses of about 2 grains (0.12 Gm.) each, repeated from four to six times a day.

DRUGS ACTING PARTICULARLY ON THE UTERUS.

EMMENAGOGUES AND ECBOLICS.

EMMENAGOGUES are remedies which restore or increase the menstrual flow. They are divided, according to their action, into two classes. Those which act upon the uterine muscle or mucous membrane are said to be *direct*, those which influence the uterus by affecting the general health of the body, or by altering the blood-supply of the parts, or by influencing the nervous system, are said to be *indirect*.

The principal Direct Emmenagogues are—

Ergot,	Borax,
Digitalis,	Rue,
Savine,	Hydrastis
Quinine,	Caulophyllum,
Asafetida,	Tansy,
Myrrh,	Apoel
Guaiac,	Hedecoma
Cantharides,	

The Indirect Emmenagogues are—

Iron and the Hematics,	Cinnamon,
Cod-liver Oil,	Aloes.
Strychnine,	

Baths	{ Hot foot-bath.
	{ Hot hip-bath.
	{ Mustard bath.
Leeches	{ To genitals.
	{ To thighs.
Mustard	{ Baths
	{ Poultices to thighs
	{ Stupes.

EMBOTICS or OXYBOTICS are remedies which act directly upon the uterine muscular fibers, inducing uterine contraction and are chiefly used during or immediately after parturition to produce or increase uterine action. They are, therefore, contraindicated before parturition, lest they induce abortion, although they are often used criminally for this purpose.

The exact manner in which ecbotics act is unknown, but it is

supposed that they act directly by in the cord, or reflexly through ut

In small doses many of the ec many of the direct emmenagogues

The only justifiable uses for e uterine inertia and unobstructed a when it is desired to hasten the d to induce firm contraction of the ut uterine hemorrhage after the birth

The principal Echolics are—

Ergot,
Ustilago,
Hydrastis,
Berberis,
Savine,
Quinine,
Cotton-root Bark,

Drugs which have not been con work will be described here:

Sabina—Sabinæ—

Origin.—The tops of *Juniperus Sabin* erect shrub, distributed throughout the gre and the Northern United States.

Description and Properties.—S leaves rather dark green, in four rows, oppo less acute, appressed, imbricated, on the bas oblong or roundish gland; odor peculiar, ten bitter.

It contains 2 per cent. of a volatile oil, ts

Dose.—5-15 grains (0.3-1.0 Gm.) [7]

Official Pre

Fluidextractum Sabinæ—**Fluidextrac**
Dose, 5-15 minims (0.3-1.0 Cc.) [5 minims (

Öleum Sabinæ—Ölei S U. S.

Origin.—A volatile oil distilled from the

Description and Properties.—A peculiar terebinthinate odor and a pungent, becomes darker and thicker by age and es volume of alcohol

Dose.—1-5 minims (0.06-0.3 Cc.) [1 n

Physiological Action and Ther
depends on the presence of the v
its local external effect from the
the oil of savine is more active. It
cation, and even pustulation whe

internally in small doses, it produces a sensation of heat in the epigastrium, with flatulence and frequently nausea. Toxic doses excite violent gastro-enteritis.

The drug stimulates the heart's action, and later, under full medicinal doses, depresses it. It is rapidly absorbed, and is excreted by various channels, increasing the urinary and bronchial excretions. These excretions, as well as the sweat and breath, smell strongly of the drug.

Savine is a decided irritant to the uterus and ovaries, inducing marked hyperemia of those organs, and promoting contractions of the pregnant uterus.

Toxic doses produce symptoms similar to those occasioned by oil of turpentine—violent gastro-enteritis, suppressed or bloody urine, great depression, etc. The treatment in poisoning by oil of savine would be full doses of Epsom salt, demulcents, anodynes, and stimulants if necessary.

Savine in the form of an ointment is used as a stimulant application to keep up the discharge from blisters. An alcoholic solution of oil of savine, 5-30 minims (0.3-1.8 Cc) to 1 ounce (30.0 Cc.), is used in *alopecia pityriasis*.

Oil of savine is a very efficient remedy in *amenorrhea*, and is also of benefit in certain cases of *menorrhagia* due to an enlarged and passively congested uterus. The hemorrhage following abortion is usually well controlled by this remedy.

The powder or fluidextract may be given, but the oil is the most effective preparation, and may be prescribed in capsules, pills, or emulsion. It should be given cautiously.

Rûta—Rûtæ—Rue. (Non-official.)

Origin—The leaves of *Ruta graveolens* L., an herbaceous or subshrubaceous perennial 2 or 3 feet (60 or 90 Cm.) high, indigenous in Southern Europe.

Description and Properties—The leaves are ternate, the leaflets being obovate-oblong, yellowish green, thickly dotted with minute, transparent vesicles. They have a peculiar, strongly balsamic odor, and possess an aromatic, bitter, and acrid taste.

The principal constituent of rue is a volatile oil.

Dose.—5 to 20 grains (0.3-1.3 Gm.)

Öleum Rûtæ—Ölei Rûtæ—Oil of Rue.

(Non-official.)

Origin—A volatile oil distilled from *Ruta graveolens* L.

Description and Properties—A colorless or greenish-yellow liquid with the peculiar odor of the plant, and a pungent, somewhat acrid, bitterish taste. Not miscible in an equal weight of alcohol.

Dose.—3-5 minims (0.1-0.3 Cc.)

Physiological Action and Therapeutics—The action of oil of rue is analogous to that of oil of savine, though less powerful. It is used for the same purposes also, and has occasionally been employed in *hysteria*.

The oil should be administered in capsules.

Tanacētum—Tanacēti-

Origin—The leaves and tops of *Tanacetum officinale* are indigenous in Europe and Central Asia, and native in North America.

Description and Properties—Leaves bipinnatifid, the segments oblong, obtuse, or glandular; flower heads corymbose, with receptacle, and numerous yellow tubular florets and bitter.

It contains a volatile oil and a bitter principle.

Dose.—15-60 grains (1.0-4.0 Gm.), &c.

Physiological Action and Therapeutics—Tansy acts as an aromatic bitter. It produces the symptoms of an irritant narcotic, as abdominal pain, loss of consciousness, and respiratory weakness, death by asphyxia.

The drug is regarded as an efficient antispasmodic and is extensively employed in domestic medicine and topically for bruises, sprains, &c.

It is used in the rural districts of France, and occasionally is employed as a cathartic, but usually with negative results.

The drug may be given in the form of a tincture (32.0 Gm.-473.17 Cc.), or 60.0 Cc.) may be taken at a dose of 10-20 Cc.

The oil of tansy is occasionally used in the form of capsules (0.06-0.3 Cc.).

Petroselinum—Petroselin-

Origin—The root of *Petroselinum* is indigenous in Southern Europe and North America.

Description and Properties—The root is 10-20 (in) long, about 1/2 inch (12 Mm.) in diameter, odor aromatic, taste sweetish and aromatic.

It contains a volatile oil and a principle, the essential oil.

Dose.—30-60 grains (2.0-4.0 Gm.).

Unofficial

Apiolum—Apioli Apiole (NON OFF.) is the fruit of *Petroselinum* as given by Hoffmann.

Description and Properties—White in color, in water, but freely soluble in alcohol and in ether.

Dose.—10-15 grains (0.6-1.0 Gm.).

Physiological Action and Therapeutics—Apiolum acts as a diuretic, laxative, and diuretic. Given in excessive doses it causes dizziness, and ringing in the ears, and increases the blood pressure, due to increased cardiovascular centers.

APIOL, or Chapoteaut's APIOL, is an efficient remedy in amenorrhoea.

menagogue in cases of scanty or deficient menstruation *ARJOLINE* is very effective.

Hedeōma—Hedeōmæ—Hedeoma. U. S. P.

(PENNYROYAL.)

Origin—The dried leaves and flowering tops of *Hedeoma pulegioides* (L.) Desfont., a small herb indigenous to North America.

Description and Properties—Leaves opposite, short-petioled, about $\frac{1}{4}$ inch (12 lines) long, ending ovate, obscurely serrate, pubescent beneath, branches small, dichotomous at base, flowers in racemes, axillary cymes, with a tubular corolla, bilobate and five-toothed calyx, and a pale-blue spotted bicolor corolla, containing two stamens and two fertile exserted stamens. Odor strong, mint-like, taste warm and pungent. Its virtues depend upon a volatile oil.

Dose.—15-60 grains (1.0-4.0 Gm.), in infusion [150 grains (8 Gm.), U. S. P.]

Official Preparation.

Ölum Hedeōmæ **Ölel Hedeōmæ**—Oil of Hedeoma (Oil of Pennyroyal).—**Origin**—A volatile oil distilled from the leaves and flowering tops of *Hedeoma*.

Description and Properties—A pale yellowish, limpid liquid, having a characteristic, pungent, mint-like odor and taste. It should be kept in well stoppered bottles, in a cool place, protected from light.

Dose.—2-10 minims (0.1-0.6 Cc.) [3 minims (0.2 Cc.), U. S. P.]

Physiological Action and Therapeutics.—Hedeoma is aromatic stimulant, carminative, and emmenagogue, while the oil is rubefacient if rubbed into the skin.

The herb is given in the form of a HOT INFUSION to bring on retarded or suspended menstruation and for the relief of flatulency, pharyngitis, bronchitis, etc., as well as to dissipate congestions of various parts.

The oil of HEDEOMA is an active emmenagogue and is used to increase the rubefacient effect of various embrocations.

Berberis—Berberidis—Barberry. U. S. P.

Definition—The rhizome and roots of *Berberis aquifolium* and other species of *Berberis*.

Berberis aquifolium is known as Oregon grape root. It contains an alkaloid for which a name has not been proposed (a drug supplied from the parent root is called *Berberis hydrocotyle* and other species).

Dose.—Average dose 30 grains (2 Gm.), U. S. P.

Official Preparation.

Fluïdextrāctum Berberidis **Fluïdextrāctū Berberidis**—Fluidextract of Berberis. **Dose**.—Average dose 30 grains (2 Gm.), U. S. P.

Physiological Action.—Berberis contains an active alkaloid, *Berberine*, an alkaloid widely distributed in the plant kingdom. Its relations to hystrastis have given it a slight reputation as a uterine stimulant, but it is hardly more than an unnecessary letter. It has no particular physiological action and little practical therapeutic worth.

DRUGS ACTING PARTICULARLY ON THE

DIURE

DIURETICS are drugs which in-
sidered in a broader sense, however
secretion and modify the character

1. By increasing the amount.
2. By rendering the urine acid.
3. By rendering the urine alkali.
4. By removing waste products of the urine.

By preventing the decomposition

The last-named action is peculiar to acids, cubeb, copaiba, uva ursi, oil of saccharin, hexamethylenamina, and

The following medicines affect the formation of concretions in the urinary tract, and are therefore contraindicated in them when formed :

Piperazin, potassium salts,* lithium benzoic acid,* dilute nitric acid.*

Among the principal drugs which contain benzoic* and salicylic acids,* and amounts of the vegetable acids,* are

The alkalis,* particularly the p

Diuretics may be either direct on the kidneys themselves or upon kidneys. The structures in the kidney are the elimination of water, solids, etc. which eliminate principally water, but also pathological and foreign substances. The *glandular epithelium lining the collecting ducts* is the organ which eliminates waste-products, such as urea, etc.

tubules, serving to prevent (according to theory) the too-rapid escape of water from the system in cases where it is desirable to maintain a high water level in the system.

The functional activity of these vessels is regulated by the nervous mechanism through its efferent innervation. For example, the supply of blood

¹ The drugs marked with an asterisk (*) are

largely by the size of the blood-vessels, regulated by the vasoconstrictor and vasodilator nerves, but it has not been proved that the secretory cells are in any way affected by the nervous mechanism.

Diuretics act.

1. By increasing the general blood-pressure.
2. By causing local dilatation of the renal arterioles.
3. By directly stimulating the glandular secreting renal structures.
4. By simple mechanical force.

The following table, modified from Brunton's work on *Pharmacology, Therapeutics, and Materia Medica*, serves to elucidate the methods by which the various diuretic agents probably exert their influence:

Raise arterial pressure.	Generally . .	Increased cardiac action.	Digitalis,* Alcohol* Digitalis,* Strophanthus,* Squill, Scopolius,* Convallaria,* Strychnine,* Caffeine,* Erythrophleum (cold to the skin).
		General vascular contraction.	
Locally on kidneys.	Contract efferent vessels.	Act on the vaso-motor centers.	Same as above? Scopolius,* Nuxia, Uva Ursi, Locally on kidney, Juniper, Turpentine, Capsaicin, Cantharides.*
		Locally on kidney.	
Act on secreting nerves and renal cells.	Dilate efferent vessels.	Act either on vaso-motor centers or locally on renal vessels.	Nitrites,* Alcohol.*
	Increase water excreted .		Urea, Caffeine,* Diuretin, Calomel* Colchicum,* Liquid Potash,* Potassium Acetate,* Potassium Citrate,* Potassium Nitrate,* Sodium Citrate* and other salts.
		Increase water and solids excreted	
By simple mechanical action			Water, local heating, dry cupping, warm leeches, etc.

The secretion of urine is controlled by the skin and bowels; for instance, when these are stimulated and there is free perspiration, secretion ensues. The functional activity of the excretory glands depends greatly upon the stimuli applied to them. Whatever augments the activity of these structures increases the secretion of urine. Frequently, external warmth dilates the cutaneous vessels, promotes diaphoresis, while cold constricts, diverting the flow of blood to the kidneys, thus increasing the secretion from the kidneys to the skin.

It will be seen, therefore, that the kidneys are compensatory, the action being observable in the mutual relations of the organs. It is well known that when there is constipation, watery movements from the bowels are proportionally diminished.

Any drug which increases the blood-supply into the kidneys, dilating the glomeruli, distending the capillaries, increasing the osmotic membrane, which action, by increasing the circulation, promotes and facilitates the amount of urine.

The blood-pressure in the glomeruli is increased by additional pressure in the aorta, which may be raised also locally through dilation of the vessels supplying the Malpighian corpuscles, dilating the vessels, allowing a smaller quantity of blood to the glomerules.

The secreting structures of the kidney are stimulated by the influence of certain constituents of the blood, acting as excitants upon them. Secretion necessarily requires an extra supply of material for the extra secretion.

The inhibition of large amount of water eliminated by the kidneys, is due to the "flushing action," and renders the action of the kidneys more efficient.

In congested conditions of the kidneys—such as local venesection etc.—promote renal secretion.

Therapeutica.—1. *To remove the excess of fluid from the tissues and serous cavities of the body.*

For this purpose the most effective is the use of drugs which act by increasing the blood-supply and stimulating the secreting cells.

Ordinarily, the agents most b

sies due to venous congestion are digitalis, calomel, scopolarius, squill, diuretin, etc.

2 To remove excess of fluid from the body when the blood-pressure is about normal, as in cases of hepatic venous with dropsy.

The remedies found to be most efficient in these conditions are diuretin, coxuba, and calomel, although frequently saline purgatives, by ridding the peritoneal cavity of excess of water and preventing the accumulation of fluid by lowering the abnormally high blood-pressure in the portal circulation, prove more beneficial than diuretics.

3. To remove water from the blood when the arterial pressure is abnormally high.

For this purpose diuretics are indicated in the early stages of many acute diseases, such as the eruptive fevers, tonsillitis, bronchitis, etc. In these cases agents which dilate the cutaneous blood-vessels, such as spirit of nitrous ether, etc., should be employed. Diaphoretics and cathartics are likewise beneficial.

4 To remove injurious waste products and poisonous substances from the blood.

For this purpose drugs which stimulate the convoluted tubules and increase oxidation should be given, such as potassium nitrate and bitartrate, the lithium salts, turpentine, juniper, diuretin, and the remedies mentioned under *Lithontriptics*.

The foregoing remedies will be found useful in diseases associated with rheumatic, gouty, and uric-acid diathesis, as well as in many acute diseases where there is rapid accumulation of deleterious, catabolic material.

5 To lessen the acidity of the urine.

The alkalis and the alkaline salts of the organic acids are the most useful agents for this purpose, being serviceable in such conditions as gonorrhea and acute inflammatory states of the genito-urinary tract. In debilitated conditions there is quite often an excessive acidity of the urine, irritating the mucous membrane and causing frequent micturition. In such cases the alkaline diuretics or alkaline mineral waters are of service.

6 To increase the acidity of the urine.

This is necessary when, from any cause, there is ammoniacal decomposition of the urine, as in cystitis. In such cases benzoic acid is probably the most beneficial remedy, though the salicylates, salol, and the volatile oils, etc., may also prove useful.

7 To prevent the formation of urinary concretions or to dissolve them when formed, as in cases of renal calculi, etc.

For these purposes the drugs included under *Lithontriptics* are the most efficient.

8 To dilute the urine.

This process is necessary to prevent the deposit of urinary solids from forming calculi in the kidneys or bladder. For this purpose water or the alkaline mineral waters, taken in large quantities, will prove most useful.

Administration.—Diuretics act upon the kidneys, and in disease proving inert. They are more employed in combination—that is, generally upon the systemic and various secreting structures of the body. In their action, they should not be too powerful.

When administered, diuretics should be given with plenty of water. The patient's skin should be kept moist, and the action prevented from acting too freely. In this class of remedies may be obtained the most beneficial results.

The diuretic drugs not described here are herewith considered in detail.

Diurētin—Diurētin—Diurētin

(SODIOSALICYLATE)

Origin.—The name indicates the origin of theobromine (49.7 per cent.) and salicylic acid, which form the mixture of theobromine and sodium salicylate.

Description and Properties.—A white, crystalline powder, soluble in water; soluble in hot water; soluble in warm alcohol; insoluble in cold water; soluble in warm alcohol; insoluble in cold water; a disagreeable, soap-like taste, and undergoes no change.

Dose.—15 grains (1.0 Gm.); 45 to 60 grains (3.0 Gm.) in divided portions in twenty-four hours.

Antagonists and Incompatibles.—Theobromine is retarded by the motor and cardiac stimulants and vegetable acids are incompatible.

Synergists.—The therapeutic effect of theobromine may be enhanced by cardiac stimulants and diuretics.

Physiological Action.—*Externally.*—Theobromine, being a xanthine derivative, is a series of compounds. See *Caffeine*.

Internally.—**Digestive System.**—Theobromine, though in many cases it may impair the appetite, and even cause diarrhea.

Circulatory System.—Theobromine, upon the system in failing compensation, influence being due to its effect upon the heart, like caffeine, exercises a direct, stimulating effect upon the epithelium and also a very slight effect upon the motor center in the medulla.

Nervous System.—Large doses of theobromine produce headache, somnolence, or insomnia, and symptoms resembling those of caffeine.

xanthin action is to stimulate the vasomotor centers, and slight stimulation of the respiratory center. Theobromine is one of the least stimulating xanthins and shows little of this action.

Respiratory System.—Diuretin exerts no direct influence upon the respiratory system. Yet dyspnea, bronchitis, etc., the result of a dropsical condition, are relieved by the administration of the drug.

Absorption and Elimination.—Diuretin is somewhat rapidly absorbed, being eliminated mainly by the kidneys, the process greatly stimulating the renal epithelium. The rise in blood-pressure is helpful, but the chief action has been shown to be on the renal epithelium. Both fluid and solid parts are increased. The chief increase in solids taking place in the chlorides. The amount of nitrogenous matter eliminated is also increased.

In cases where diuretin is indicated the amount of urine is increased from three- to sixfold in twenty-four hours, under its administration the diuretic action of the drug gradually reaching its maximum between the second and third days. In the case of healthy persons diuretin has little influence upon the amount of urine excreted.

Untoward Action.—In certain individuals the drug causes great disturbance of the gastro-intestinal tract, such as nausea, vomiting, diarrhea, palpitation of the heart, headache, and slight fever; occasionally cutaneous eruptions may be present.

Poisoning.—No cases of poisoning are recorded.

Therapeutics.—The drug is used exclusively as a diuretic in cases of *dropsy, ascites, pleuritic effusion, etc.*

Diuretin is worthy of a thorough trial for the removal of *dropical fluids*, irrespective of the cause.

Diuretin is best suited to cases in which there is *general dropical effusion*. It is the best medicinal remedy for removing dropical fluid due to *valvular disease of the heart* after digitalis and pure cardiac tonics have failed. Diuretin has oftentimes a beneficial effect in other circulatory diseases with dropsy, as *myocarditis, pericarditis, aneurism, arteriosclerosis*. Its action is here more uncertain than in valvular disease. In the *dropsy of nephritis* it can be used without danger of irritating the kidney, the effects in *acute nephritis* being more certain than in chronic nephritis. Where the renal epithelium has undergone too extensive degeneration the drug may fail to act. In the *dropsy of portal obstruction*, and especially of *cirrhosis of the liver*, it usually fails to give good results.

Contraindications.—There are no special contraindications to the use of diuretin, unless it be in cases of marked gastric irritation, when the drug would undoubtedly aggravate the symptoms.

Administration.—Diuretin may be given in capsules or dissolved in some aromatic water or in milk. It should never be dispensed in powders, since it absorbs carbonic acid from the air and undergoes decomposition.

It is preferable to give the drug associated with digitalis and similar the cardiac remedies the doses of

When giving this drug in case removal of large quantities of drops be small and gradually increased to the desired effect be produced, less fluid alarming collapse ensue.

As acids are incompatible with given immediately after meals, but about three hours to avoid unpleasant action of the gastric juice upon the

The practice of adding fruit as diuretic for the purpose of rendering strictly avoided, since the theobromine acids as a thick white sediment

The maximum daily amount is 150 grains (9.72 Gm.). The average (2.9-7.0 Gm.), given in divided (1.0 Gm.) each.

If diuresis is not increased it should be suspended and recourse

Piperazinum—Piperazine-

(PIPERAZIDINE; ETHYLENEIMINE; J)

Origin.—Obtained by the action of ammonia on ethylene chloride.

Description and Properties.—Soluble in water, the solution being practically colorless. The drug is very deliquescent, becoming completely liquid.

Dose.—5-15 grains (0.3-1.0 Gm.).

PIPERAZIN, LYCETOL, LYSIDIN and related compounds, all introduced since a partial death blow has been dealt to "uric-acid phobia," the therapy sought after. What is here written of this entire series of bodies.

Antagonists and Incompatibles.—Tannic acid, preparations of Donovan's solution, acetanilid, p

Synergists.—Lithium and its

Physiological Action and Therapeutics.—The drug has no effect whatever upon the respiratory systems. Excessive nervous system, producing certain muscular tremors, hallucinations

The drug is non-irritating when

Piperazin is rapidly absorbed from the stomach, circulates in the blood unchanged, and is eliminated in the urine.

The only important action of piperazin is its property of dissolving uric acid, with which it forms a neutral and exceedingly soluble salt, piperazin urate, said to be seven times more soluble in water than lithium urate. This action is prominent in test-tubes, but it is highly doubtful if it is as serviceable in the human body.

Therapeutics—*Externally and Locally*.—A solution of piperazin (1 to 2 per cent.) in a mixture of water and alcohol (1 to 4, respectively) has been applied locally to gonorrheal joints and swellings with doubtful results.

Solutions of papiazin may be injected into the bladder in order to dissolve retained calculi. They seem to have a slight action

In the treatment of gout some observers have reported good results. For renal and vesical calculi of the urates it is doubtful if this drug is of much service, yet it is worthy of extended trial. It is of service in *chronic cystitis* and in some forms of *arthritis*. The *granular diabetes* is often benefited by it.

The good results which have been reported from the use of these unis-acid solvents is largely to be attributed to the immense quantities of water with which their administration is combined.

Contraindications—None of importance can be named.

Administration—Lipetamin is best given in aerated water, although it may be acceptably administered in distilled water and syrup, orange flower water, or other agreeable vehicle.

Hexamethylenamina - Hexamethylenaminæ - Hexamethylenamine. U. S. P.

Definition A \mathbb{C} -algebra is a product of simple algebras and zero divisors. (H.S. Chern, 1911) It is important to note that the definition of simple algebras is given by the condition that they have no non-trivial two-sided ideals.

Description and Properties—The crystals are rhombic, having a sweetish, then a somewhat bitter taste. The aqueous solution has a faint reaction to litmus and turns blue in water 1:15, and white in 1:100. It is precipitated by excess of hydrochloric acid, and its solution in water is precipitated by excess of ammonia and iron chloride.

Dues: Average due 4 years 0.52 rem 1 = 250 malig. cases, 1 N F

Alkal Compounds

Hesperomys eremicus (L.) - 100000, with a large number of sub-

Hexamethylcyclotriphosphoramide is a cyclic triphosphoramide, $\text{C}_6\text{H}_{12}\text{N}_6\text{P}_3\text{O}_3$, and is a colorless, odorless, crystalline solid. It is soluble in water and organic solvents. It is used in the synthesis of various phosphorus compounds and as a flame retardant.

Hexamethylenamine ethyle n-ide bromelin, or bromoformin, a colorless, oily liquid, soluble in water and alcohol.

1,3,5-trimethylenetetraaminetannin, tannopin, or tannon, a tr. w. tasteless, white, crystalline substance, m. p. 150-151° C.

Di-isobenzyl-hexamethylenamine, tetralin, contains 80 per cent of base

Chlorotriphenyl and chloroform are products of decomposition. Helmut is a toxic chemical and is used in many chemical reactions. Chlorotriphenyl and chloroform are both used in the synthesis of many organic compounds. Chlorotriphenyl is used in the synthesis of many organic compounds. Chloroform is used in the synthesis of many organic compounds.

Therapeutics.—The chief act as a germicide in the urine, broken down as formaldehyde, titis, in gonorrhea, in typhoid fever it is desired to avoid urinary infection.

Scilla—Scillæ—

Origin.—The bulb of *Urginea maritima* of the Mediterranean, from Syria where the bulb is deprived of its dry, membranaceous central portions being rejected.

Description and Properties.—(5 cm.) long, slightly translucent, yellowish when dry, tough and flexible after exposure to moisture, bitter, and acid. Merck isolated the (both acting upon the heart), and *scillarin* (a stimulant substance, such as mucilage been found to be identical with Merck's scillarin).

Dose.—1-4 grains (0.06-0.25 Gm.)

Official Preparations

Acetum Scillæ—Aceti Scillæ—Vina Scillæ 30 minims (0.6-2.0 Ce.) [15 minims (1 Ce.)]

Fluidextractum Scillæ—Fluidextractum Scillæ 1-4 minims (0.065-0.25 Ce.) [1 1/2 minims (0.075-0.25 Ce.)]

Syrupus Scillæ—Syrupi Scillæ—Syrupus Scillæ 30-60 minims (2.0-4.0 Ce.) [30 minims (1.0-2.0 Ce.)]

Syrupus Scillæ Compositus—Syrupus Scillæ Compositus 30-60 minims (2.0-4.0 Ce.) [30 minims (1.0-2.0 Ce.)]

of Squill—Fluidextract 8 per cent., with emetic 0.2 per cent., or 1/4 grain (0.008 Gm.) to 2 flu drams (1.0-8.0 Ce.) [30 minims (1.0-8.0 Ce.)]

Tinctura Scillæ—Tinctura Scillæ—Tinctura Scillæ 5-20 minims (0.3-1.3 Ce.) [15 minims (0.75-2.6 Ce.)]

Antagonists and Incompatibles.—The circulatory system is antagonized by tannic acid is incompatible.

Synergists.—The diuretic action of the drug is aided by senega and digitalis.

Physiological Action.—The action of special importance. However, squill acts as an irritant.

Internally.—Digestive System.—Nausea, vomiting, and purging, gastro-enteritis.

Circulatory System.—The action upon the blood-vessels resembles that of digitalis is the more pronounced.

Nervous System.—Squills has a stimulant action in medicinal doses.

Respiratory System.—The bronchopneumonia facilitated by small doses, the respiration rapid and shallow.

Absorption and Elimination—The active principles of squill are quickly diffused through the blood, being eliminated chiefly by the kidneys and bronchial mucous membrane.

In the passage of squill through the kidneys the renal epithelium is stimulated by the drug, which influence, together with the drug's action upon the systemic circulation, renders squill an active and valuable diuretic, increasing not only the amount of urine, but also the quantity of inorganic solids.

Very large doses irritate and inflame the kidneys, resulting in strangury and hematuria, with occasionally entire suppression of urinary flow.

Untoward Action—This does not differ essentially from the symptoms of "Poisoning."

Poisoning—In toxic doses squill acts as an acrid narcotic poison. The symptoms produced by excessive doses are—nausea, violent vomiting, serous and bloody diarrhea, severe griping, a sensation of burning in the throat, vesical tenesmus accompanied by pain, bloody urine, and, perhaps, entire suppression of the urinary flow. The pulse is feeble and slow or sometimes rapid, the symptoms terminating in collapse and death, occasionally preceded by convulsions. The death of a child three to five years of age has occurred from the taking of a half-teaspoonful of the syrup of squill.

Treatment of Poisoning—The stomach should be evacuated and demulcent drinks freely given. Opium may be necessary to relieve pain, while diffusible stimulants serve to counteract cardiac and respiratory depression. Otherwise as in digitalis poisoning.

Therapeutics.—SQUILL is not used externally and locally. It has been employed internally as a diuretic in *dropsy*. When associated with digitalis and calomel it is an exceedingly active diuretic in cases of *cardiac dropsy*, *chronic pleurisy*, and *pericarditis with effusion*.

Squill is an efficient expectorant, the *VINEGAR*, *SYRUP*, and *COMPOUND SYRUP OF SQUILL* being useful preparations in *subacute* and *chronic forms of bronchitis*, particularly when the sputum is tenacious and expelled with difficulty.

Contraindications—Squill should not be employed in cases of acute diseases of the kidneys. It is also inadmissible in acute bronchitis and in phthisis.

Administration—Any of the preparations of the drug may be given, to be prescribed well diluted with syrup or glycerin.

Inasmuch as the diuretic action of squill ceases after a while, the doses should be repeated and gradually enlarged until some untoward action intervenes, when further increase should be suspended.

Because of its too-irritating properties the drug is seldom given alone when desired for its diuretic action.

Owing to the free acetic acid which it contains, syrup of squill is incompatible with ammonium carbonate and other alkalis.

Erythrophlëum—Erythr

(Non-o

(CASCA

Origin.—A glycosid obtained from the bark of a tree known under the names of *Casca bark*, *S* native of West Africa, the plant being used

Description and Properties.—*ally employed, occurs in the form of white*

Dose.— $\frac{1}{10}$ – $\frac{1}{2}$ grain (0.01–0.005 Gm.)

Physiological Action and T
when inhaled causes violent sne
or the glycosid, when taken in p
vomiting, purging, intense headac
death.

In medicinal doses the drug i
the manner of digitalis, and act
diuretic. It was at one time sup
thetic; further examination, how
unfounded.

Casca bark or its glycosid has l
diarrhea, dysentery, and dyspept
valvular disease of the heart and
dropsies.

Administration.—A tincture
may be given internally, diluted w
(0.3–0.6 Cc.). Erythrophlein hyc
dermically.

Büchu—Büchu-

Origin.—The dried leaves of *Barr*
land, a shrub attaining a height of several
Africa, particularly in various parts of Cap

Description and Properties.—
long, roundish obovate, with rather wedge
obovate, crenate or serrate, with a gran
green, thickish, pellucid-punctate; odor i
like, pungent, and bitterish. Büchu cont
which, on exposure to a low temperatur
C₁₀H₁₆O₂. The bitter-principle of büchu

Dose.—15–30 grains (1.0–2.0 Gm.)

Official

Fluidextractum Büchu—Fluidextr
Dose, 15–30 minims (1.0–2.0 Cc.) [30 min

Physiological Action and
locally büchu has no action o
acts as a carminative, in small
warmth, but in excessive doses

Upon the circulation the infl
stimulant.

Its active constituents are rapidly diffused through the blood, and are eliminated principally by the kidneys, the bronchial mucous membrane sharing in the excretory process.

Buchu increases the fluid and solid constituents of the urine, imparting to it a peculiar aromatic odor. The drug acts as a tonic astringent and disinfectant to the mucous membranes, from which it is eliminated, diminishing the secretions.

If taken for too long a period, irritation and inflammation of the kidneys are apt to ensue because of excessive stimulation.

The drug is chiefly employed as a stimulant diuretic and expectorant in catarrhal conditions of the genito-urinary organs and bronchial tubes. Buchu is therefore of service in *urethritis*, *gonorrhea*, *gleet*, *chronic cystitis*, *incontinence of urine* due to want of muscular tone, *pyelitis*, etc. The drug has also proved beneficial in certain cases of *chronic bronchitis*, and has even been recommended in *chronic rheumatism* and *lithemia*.

Contraindications.—Buchu is contraindicated in acute inflammation of the kidneys.

Administration.—The fluidextract and the infusion are the only preparations employed. They should be given freely diluted with water.

Ova Ūrsi—Ovæ Ūrsi—Uva Ursi. U. S. P.

(BERRBERRY)

Origin.—The dried leaves of *Aristotaphylos Uva Ursi* (L.) Sprengel, a trailing evergreen, are distributed throughout the northern portion of North America, extending as far south as New Jersey and westward to Colorado. The plant is also found in most western Europe and in Northern Asia.

Description and Properties.—Leaves very short-stemmed, oblong-ovate-oblong, minutely serrulate, coriaceous, about 1 inch (2.5 cm.) long and $\frac{1}{4}$ to $\frac{1}{2}$ inch (6.5-12 mm.) wide, obscure, with slightly revolute edges, upper surface with serrated veins a few millimeters distinctly reticulate, color faint, hairless, taste strongly astringent and somewhat bitter.

Uva ursi contains three glycosides, *arbutin*, *methylarbutin*, and *rosolin*, and a tasteless principle, *arabin*, besides tannin and *gallic acid*.

Dose.—15-60 grains (1.0-4.0 gm.) [$\frac{1}{2}$ to 2 grains (2 Gm.), U. S. P.]

Official Preparation

Fluidextractum Ova Ursi—Fluidextracti Ovæ Ursi—Fluidextract of Uva Ursi.—*Uva*, 15-60 minims (1.0-4.0 Gm.) [$\frac{1}{2}$ to 2 minims (2 Gm.), U. S. P.]

The physiological action and therapeutics of uva ursi are analogous to those of buchu. The arbutin and methylarbutin are capable of being split into glucose and hydroquinon or methylhydroquinon, to which latter substances the antiseptic action of this drug is due. Hence uva ursi is particularly valuable as a urinary antiseptic. It is of service in cystitis especially and is a useful drug in prostatic hypertrophy to limit urinary infection.

Juniperus—Juniperi—

(JUNIPER)

Origin.—The fruit of *Juniperus* comes from the northern hemisphere and is found in the U. S.

Description and Properties.—The fruit is externally of a glossy, purplish black color, has an aromatic, balsamic odor, and a sweet taste. Juniper contains a volatile oil; also

Dose.—15-60 grains (1.0-4.0 Gm.).

Öleum Juniperi—Ölei J

U. S.

Origin.—A volatile oil distilled from

Description and Properties.—becoming darker and thicker through age; a color of juniper and a warm, aromatic, odor. Soluble in about four times its volume of alcohol, which is neutral or slightly acid to litmus-paper.

Dose.—5-25 minims (0.3-1.0 Cc.) [3

Official P

Spiritus Juniperi—Spiritus Juniperi (4.0-30.0 Cc.). **Formula.** Oil of juniper, U. S. P.]

Spiritus Juniperi Compositus—Sp
Spirit of Juniper.—**Formula.** Oil of juniper, alcohol, 1700; water, sufficient to make 200 [2 fluidrams (8 Cc.), U. S. P.].

Physiological Action and Therapeutics.—It resembles buchu, being a stimulant. In large doses it acts as a diaphoretic. It is a mild aphrodisiac.

The volatile oil, which is taken internally, diffuses through the blood with glycerine, and, in dropsical conditions, in moderate health, however, the amount of urea is augmented.

Juniper is used for the same purposes as to the latter drug perhaps—*as a remedy in passive congestion of the kidneys*.

Contraindications.—The same as for the latter drug.

Administration.—Any of the above, being a popular diuretic.

Copaiba—Copaibæ

(BALSAM OF

Definition.—An oleoresin derived from *Copaiba*.

Description and Properties.—A viscid liquid of a pale yellow to brownish yellow color.

and a bitter, acrid taste. Insoluble in water, readily soluble in absolute alcohol, ether, chloroform, carbon disulphide, benzoin, and fixed and volatile oils.

Copaiba contains a resin, *resina copaiba*, *copaiba-acid* (soluble in absolute alcohol and in carbon disulphide), and a bitter principle.

Dose.—5-30 minims (0.3-2.0 Cc.) [15 minims (1 Cc.), U. S. P.] in emulsion or capsule.

Öleum Copaibæ—Ölei Copaibæ—Oil of Copaiba.

U. S. P.

Origin.—A volatile oil distilled from *copaiba*.

Description and Properties.—A colorless or pale yellowish liquid, having the characteristic odor of *copaiba* and an aromatic, bitterish, and a pungent taste. Soluble in about ten times its volume of alcohol, forming a slightly turbid liquid, which is neutral to litmus paper. The drug should be kept in well-stoppered bottles, in a cool place. Caryophyllene is an important constituent of the oil.

Dose.—5-15 minims (0.3-1.0 Cc.) [8 minims (5 Cc.), U. S. P.]

Antagonists and Incompatibles.—*Copaiba* is antagonized by the same drugs which antagonize turpentine. It is pharmaceutically incompatible with aqueous preparations.

Synergists.—The same as for turpentine.

Physiological Action.—*Externally and Locally.*—*Copaiba* has no influence of importance, being but slightly stimulant to the skin.

Internally.—Digestive System.—Its action is analogous to that of turpentine and the volatile oils. The ingestion of the drug, even in small doses, is almost always succeeded by eructations tasting of *copaiba*.

Copaiba exerts no special influence upon the circulatory, nervous, and respiratory systems.

Absorption and Elimination.—The drug enters the circulation with facility, and is slowly eliminated by the skin and mucous membranes generally, although chiefly by the kidneys. The resin which the drug contains is a powerful stimulant of the genito-urinary structures, increasing the quantity, and to some extent the solid constituents, of the urine. Large doses irritate the kidneys, occasionally producing strangury, bloody urine, pain in the bladder, etc.

Under the use of *copaiba* albumin is sometimes found in the urine. Frequently the nitric-acid test with urine may give a reaction as if for albumin, the conclusions being then erroneous, since the resin of *copaiba* eliminated in the urine is by the action of nitric acid precipitated as a milky cloud, readily differentiated from albumin by heating the urine or mixing it with alcohol, by both of which means the resinous precipitate is dissolved.

Copaiba acts as a stimulant and disinfectant at the points of elimination, in medicinal amounts increasing secretion and imparting to the secretion from the kidneys, bronchial mucous membrane, and skin a peculiar, fragrant odor.

Untoward Action.—It often happens that after a few days' administration of *copaiba* there is produced in certain individuals an eruption, usually resembling roseola, which later may be trans-

formed into true papules; or the in character, or a true eczema is noticeable on the upper and lower and knees, malleoli, etc., and are

Under the prolonged use of the disturbances of the digestive and

Poisoning.—In addition to the mentioned, very large doses of cop to those described under Turpentine in which excessive amounts of attacks.

Treatment of Poisoning.—This under Turpentine.

Therapeutics.—*Externally* as in chronic diseases of the skin, the drug has proved valuable in frost

Internally—The principal use disinfectant of the genito-urinary gonorrhea, vaginitis, cystitis, pyelitis

In ascites and dropsical conditions hepatic and cardiac diseases, the efficient and reliable diuretic. Its tolerance appears to be established

COPAIBA is a valuable remedy in chronic cough with offensive expectoration

The drug has been at times given in psoriasis, urticaria, etc., although these disorders is less common than

The drug has found enthusiastic use in chronic diarrhea and dysentery, in chronic proctitis and chronic intestinal

Contraindications.—The same as for turpentine.

Administration.—The methods for turpentine are applicable to those of the untoward manifestations prevented by giving the drug with as in the Pharmacopœia of 1890 contained in the "Massa Copaibæ." Yet, less likely to produce untoward results therapeutically than the single drug

Sabāl—Sabāl—

Definition.—The partially dried ripe fruit of the saw palmetto.

Very little is known concerning the active principles, a fixed oil, a fat, an alkaloid, a resin, a

Dose.—Average dose: 15 grains (1 Gm.)

Physiological Action.—The drug acts in a manner similar to the oil of

Therapeutics.—It is useful in the chronic stages of gleet and in the cystitis of hypertrophied prostate.

Öleum Santali—Ölei Santali—Oil of Santal. **U. S. P.**

(OIL OF SANDALWOOD.)

Origin.—A volatile oil distilled from the wood of *Santalum album* L., yielding not less than 90 per cent of resinous material as santal. *Santalum album* is a small tree or shrub growing in Southern India and portions of the East Indies.

Description and Properties.—A pale yellowish or yellow, somewhat thickish liquid, having a peculiar, strongly aromatic odor and a pungent, spicy taste, readily soluble in alcohol. It is frequently adulterated with oil of cedar.

Dose.—3-20 minims (0.1-2 Cc.) [8 minims (0.5 Cc.) U. S. P.]

Physiological Action and Therapeutics.—The action of oil of sandalwood resembles closely that of copaiba and it may be given for the same purposes as the latter drug, although oil of sandalwood is more popular, and ordinarily a more efficient, remedy for *gonorrhœa*, particularly in the early stages. Sandalwood oil is one of the mildest of the genito-urinary stimulants. It is very frequently adulterated with a worthless oil of cedar.

Administration.—The same as in the case of copaiba.

Cubëba—Cubëbæ—Cubeb. U. S. P.

Origin.—The dried, unripe, but fully grown fruit of *Peper Cubeba* L. ac. fil., a climber, growing about about 10 feet tall, in the East Indies.

Description and Properties.—The dried fruit is about 1/2 inch in diameter, cylindrical at the base, into a rounded shape above, from 1/2 inch long to 1/2 inch long, reticulate wrinkled, brownish green, sometimes whitish and hollow. The taste is acrid and pungent. It contains from 5 to 15 per cent of a resinous, aromatic principle, cubebæ, and a diuretic principle, cubebæ, also traces of resin, fat, wax, and starch.

Dose.—3-60 grains (0.35-4.0 Gm.) [15 grains (1 Gm.) U. S. P.]

Official Preparations.

Fluidextractum Cubëbæ. **Fluidextracti Cubëbæ.** **Fluidextract of Cubebæ.**—*Dose.* 3-60 minims (0.35-4.0 Cc.) [15 minims (1 Cc.) U. S. P.]

Oleoresina Cubëbæ. **Oleoresinæ Cubëbæ.** **Oleoresin of Cubebæ.**—*Dose.* 15-30 minims (0.9-2.0 Cc.) [25 minims (1.5 Cc.) U. S. P.]

Trochisci Cubëbæ. **Trochiscos Cubëbæ.** **Troches of Cubebæ.**—(Each troche contains 15 grains (0.9 Cc.) of the vegetable.)—*Dose.* 1-10 troches.

Öleum Cubëbæ—Ölei Cubëbæ—Oil of Cubebæ. **U. S. P.**

Origin.—A volatile oil distilled from cubebæ.

Description and Properties.—A colorless, pale greenish, or yellowish liquid, having the characteristic odor of cubebæ and a warm, acrid, and pungent taste. It should be kept in well-stoppered bottles, in a cool place, protected from light.

Dose.—5-15 minims (0.3-1.0 Cc.) [5 minims (0.3 Cc.) U. S. P.]

Synergists.—Buchu, copaiba, oil of santal, black pepper, and many of the aromatic and volatile oils.

Physiological Action.—*Externally*, aromatics and drugs containing a rubefacient when applied by inun-

Internally.—*Digestive System.*—an aromatic stomachic, increasing secretion. As is the case with other or the too prolonged use of sm and deranges digestion, cubeb ac a sensation of heat and discomfort.

Internally it has the general a
Absorption and Elimination.—with considerable rapidity. It e the urine, though the skin and b in the excretory process. The and disinfectant to the structures consequently a diuretic, expector

The urine and the amount of the drug appearing in the urine may be precipitated by nitric ac of albumin.

Untoward Action.—Cubeb occ ance in the gastro-intestinal tr The most frequent untoward ma cutaneous eruptions, appearing i times as a diffuse erythema. N eruptions, which usually disappe the drug.

Poisoning.—Although cubeb large doses may be followed by a intestinal irritation.

Treatment of Poisoning.—Th stomach, favor elimination, and t by the use of demulcents, anody

Therapeutics.—*Externally* an servedly popular remedy in man The insufflation of an impalpabl tion of smoke from the burning c sense of oppression arising from membrane.

The troches of cubeb are ex ness, etc. The oil of cubeb is v application in many diseases of th

Internally.—Cubeb is used in poses as copaiba, although by n inferior to the latter drug in genit

Contraindications.—The sam

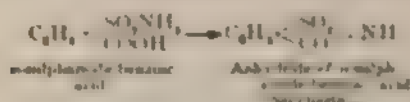
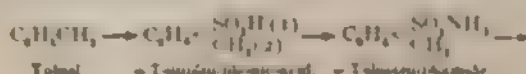
Administration.—Any of the oleoresin is best administered in c

Benzosulphinidum—Benzosulphinidi—Benzosulphinide. U. S. P.

(SACCHARIN.)

Definition—An anhydride of orthosulphamide benzoic acid, $(C_6H_4SO_2)(NH)$. It is variously known as *glucosaminide*, *saccharin*, *saccharinide*, *saccharone*, *saccharin*, etc.

Description and Properties—Its derivation from toluol (from which it is usually made) is shown by the following formulas.



Saccharin was discovered in 1879 by Ira Remser and C. Fahlberg. It is a white, crystalline powder, nearly odorless, having an intensely sweet taste even in dilute solutions. The sweet taste may be recognized in a solution of 1 part per 100,000, as compared with cane sugar 1 : 2000. Soluble in 50 parts of water and in 25 parts of alcohol, more so in boiling water (1 : 24). It behaves like a strong acid and dissolves readily in alkalis, the sodium salt $(C_6H_4SO_2)(NH)Na$ is known as *saccharin sodium* or *saccharinate*.

The Laporte Saccharin of the National Formulary is a solution of saccharin in sodium bicarbonate and alcohol. There are a number of preparations on the market such as *intestinection*, which contain saccharin (1 part).

Dose—Average dose 1 grain or 200 (m—300 mgm) grains. (U. S. P.)

Phasin or *inulin*, another very sweet substance, is para phenyl carbamide, *inulin* is a similar product.

Physiological Action.—In a neutral or alkaline medium, saccharin acts as an antiseptic. Internally it exerts no notable influence. It is said that when mixed with food it interferes with the action of saliva upon starch, and it is thought to retard the action of the other digestive ferments. The drug is not decomposed in the body, and is eliminated by the kidneys unchanged, increasing the amount of chlorides excreted in the urine, which fluid is so influenced by the drug that it does not so readily undergo fermentation.

Therapeutics.—*Externally and Locally*—Saccharin is used as a mouth wash, being especially beneficial in *stomatitis*. Feltz of Rouen, highly recommends the application of a solution of saccharin in *ozena*.

Internally—The principal use of the drug is as a substitute for sugar in cases of *diabetes*. It is sometimes useful as an antiseptic in cystitis. It also acts as benzoic acid in limiting intestinal putrefaction as well.

The drug is extensively used in various elixirs, syrups, etc., to overcome the bitterness of quinine and other bitter alkaloids.

Administration.—Saccharin should be given in solution, or in tablets which may be dissolved singly in a cup of coffee.

Physiology.—
aromatics and drug
rubefacient wh

Internally.
an aromatic st
tion. As is the
or the too pr
and deranges
a sensation of

Internally it has

Absorption.
with considerable
the urine, though the
in the excretory
and disinfectant
consequently a d

The urine and th
the drug appear
may be precipitat
of albumin.

Untoward Acti
ance in the gas
The most frequ
cutaneous eruption
times as a diffuse
eruptions, which
the drug.

Poisoning.—A
large doses may
intestinal irritatio

Treatment of
stomach, favor ed
by the use of dem.

Therapeutics.—
servedly popular
The insufflation of
tion of smoke from
sense of oppression
membrane.

The troches of
ness, etc. The oil
application in many

Internally.—Cub
poses as copaiba, al
inferior to the latter

Contraindication

Administration.—
oleoresin is best admi

... **ORTHUR** :

10.0;

11.0;

q. s. 100.0.

... experiment.

45 grains;

30 grains;

10 ounces.

... sugar for sweetening purposes.

—Methylthioninæ
Methylthionine Hydrochloride.

... (BLUE)

... hydrochloride.

... powder, or prismatic crystals having a
... somewhat less so in alcohol; the solu
... with potassium iodide. Reducing agents
... with commercial methylene blue, which is
... methylthionine, is employed as a dye or

... 250 milligrammes, U. S. P.

... cellular antiseptic, useful in de-
It is also of value in genito-urinary

DIAPHORETICS.

DIAPHORETICS—or *sudorifics*, as they are also called—are medicines which promote diaphoresis or sweating. Their action in stimulating transpiration by the skin may be enhanced by exercise, external warmth, nauseants, and drugs which dilate the vessels, determining more blood to the cutaneous blood-vessels.

Diaphoretics are employed principally for their evacuant, revulsive, and alterative effects, and to promote absorption. Some of the drugs here considered might be classed with those whose chief action is on the spinal cord. Toxicologically they affect the cord—therapeutically they are used mainly as diaphoretics. This is particularly true of **PILOCARPUS** and **PHYSENTIGMA**.

Pilocârpus—Pilocârpi—Pilocarpus. U. S. P.

(LABRANDE.)

Origin—The leaflets of *Picrospon. jaborandi* Holms. or of *Pilocarpus microphyllus* L., yielding not less than 15 per cent. of alkaloids.

Description and Proportion—*Pilocarpus* contains a crystalline and two alkaloids, *pilocarpine* and *jaborine*, the latter being thought to be chemically identical with the former.

Pilocarpine in many ways the equivalent of *pilocarpus*, has recently been isolated.

Dose— $\frac{1}{2}$ to 1 grain (0.03-0.06 Gm.).

Official Preparations.

Fluidextractum Pilocârpi—Fluidextracti Pilocârpi—Fluidextract of Pilocarpus. *U. S. P.*

Pilocarpine Hydrochloridum—Pilocarpine Hydrochloride—Pilocarpine Hydrochloride. *U. S. P.* The hydrochloride is a white crystalline solid, soluble in water and alcohol. It is very sensitive to light and moisture, and decomposes on exposure to damp air. Very soluble in water and in alcohol. It should be kept in small, well-stoppered bottles.

Pilocarpine Nitras—Pilocarpine Nitratis—Pilocarpine Nitrate. *U. S. P.* The nitrate is $\text{H}_2\text{N}_2\text{O}_4$, HNO_3 , and is a white crystalline solid, soluble in water and alcohol. It is very sensitive to light and moisture, and decomposes on exposure to damp air. Very soluble in water and in alcohol. It should be kept in small, well-stoppered bottles.

Dose—Average dose $\frac{1}{2}$ grain (0.03 Gm.)—10 milligrammes, $\frac{1}{2}$ —1.

Antagonists and Incompatibles.—Atropine is a physiological antagonist to pilocarpine, being directly opposite in its action throughout its entire range, $\frac{1}{2}$ grain (0.03 Gm.) being sufficient to counteract $\frac{1}{2}$ grain (0.03 Gm.) of pilocarpine. Morphine relieves the nausea.

The incompatibles are tannic acid, caustic alkalis, and the ferrous and metallic salts.

Synergists.—The cardiac depressants, particularly aconite and

veratrum viride, gelsemium, spiriti
paralyze the vasomotor system.

Physiological Action.—*Ext*
action of importance.

Internally.—*Digestive System*
given, since the alkaloid fully re

When pilocarpine is taken
chorda tympani and secretory
increased secretion of saliva. S
is a feeling of tenderness in th
produced. There is also a mark

The gastric glands are stim
secretion being augmented. By
fibers pilocarpine increases perist
intestines, in large doses acting as
may also induce vomiting. The
affected by moderate amounts of

Circulatory System.—At first
resulting in a slowed heart; but
palpitating heart action with raise

Nervous System.—In medicin
ceptible action on the central ner
the nerve-terminations of involu
stomach, intestines, heart, spleen

Poisonous doses have produc
followed by paralysis, the result
spinal centers, the nerves appare

Respiratory System.—The res
by medicinal amounts, but the br

Absorption and Elimination.—
and is eliminated principally by
under large doses excessive, diap

The sweat is at first acid, th
reaction. The diaphoresis produc
lation of the secretory nerves sup

The kidneys, under small do
slight increase in the urine, and t
augmented. This may be a resu
sis caused by this drug on the bl

The drug is also eliminated b
frequently an enormous increase
the influence of pilocarpine the
bronchial, and lacrymal secretio
being notably augmented. Cush
galactagogue.

Temperature.—Succeeding a
temperature there is a decided di
from the dilatation of cutaneous
of the perspiration.

Eye.—Whether applied locally to the eye or taken internally, pilocarpine produces marked contraction of the pupil by stimulating the peripheral endings of the motor oculi nerves. The drug produces a primary increase of tension of the eyeball, followed by a more permanent diminution in tension.

Uterus.—There is authority for the statement that pilocarpine stimulates the gravid uterus, inducing uterine contractions or increasing the energy of those already established.

The effect of the drug upon the uterus, however, is more pronounced and apparent in cases of eclampsia, seeming to prove the fallacy of the statement that pilocarpine is a true ecbole.

Untoward Action.—Nausea and vomiting are of quite frequent occurrence, the vomiting being preceded by long and distressing nausea. Occasionally the patient complains of severe pain in the urethra and in the lumbar region, with frequent desire to micturate.

There have often been present headache, vertigo, hiccough, dimness of vision, gastric and abdominal pains, stupor, and chilliness. Collapse may occur.

Poisoning.—The symptoms produced by poisonous doses of pilocarpine are exaggerations of those already described, together with diarrhea, exhausting and excessive sweating and salivation, marked cardiac and respiratory depression, and collapse.

Treatment of Poisoning.—If the drug has been ingested, the stomach should be immediately cleansed with a solution of tannic acid.

To counteract the untoward effects of pilocarpine, whether the drug has been ingested or given by subcutaneous injection, atropine is undoubtedly the most complete physiological antagonist, and should be given hypodermically. Morphine is indicated to control the nausea and vomiting, while some of the cardiac stimulants may be required to counteract cardiac depression.

Therapeutics.—*Externally and Locally*.—Pilocarpine, or the fluidextract of *SARONIA*, has been highly recommended for *alopecia*. By the use of pilocarpine the hair becomes darker. The fluidextract of *PILOCARPUS* has been employed as a local application in *erysipelas* and *eczema*.

Lozenges containing $\frac{1}{8}$ grain (0.001 Gm.) of pilocarpine are efficient in relieving *dryness of the throat*. As a myotic, pilocarpine is used in many diseases of the eye.

Internally.—The principal internal use of pilocarpine is as a diaphoretic in *Bright's disease*. It eliminates through the skin many products, particularly fluids, that otherwise must be eliminated by an overtaxed kidney. In cardiac dropsy it is not a safe remedy, because of its depressing influence upon the heart.

The drug is very efficient in removing *neuritic effusion*, while in *uremic poisoning* it is unquestionably a valuable remedy.

The hypodermic injection of small doses of pilocarpine has been highly recommended as an efficient remedy in *erysipelas*, particularly during the first stages of the disease.

The drug has proved beneficial in *tabacco* and *alcoholic amblyopia*.

PILOCARPINE has been found *in* *rheumatism*, and *in* *hiccough*, and, in *smallpox*, *phthisis* and for the relief of *pedal* *galactagogue*, and has been used *in* *enlargement of the cervical glands*, *in* *hyperhidrosis*.

PILOCARPINE materially lessens *hyperhidrosis*, and in many diseases of the skin the drug serves a useful purpose.

The property possessed by pilocarpine of stimulating the glands of the skin renders this drug of great value in the treatment of chronic diseases of the skin characterized by dryness. It is a peculiarly valuable agent in the treatment of the various forms of *eczema*, *pruritus senilis*, *psoriasis*, etc. The TRACT OF JABORANDI may be used in the treatment of these diseases.

Finally, PILOCARPINE has been used in the treatment of *jaundice*, and is one of the most valuable drugs in the treatment of *poisoning*.

Contraindications.—The drug is contraindicated in cases where the heart is weak from thinning of the myocardium, or where there is fatty degeneration, nor where there is congestion and edema. The drug is contraindicated in cases of fevers, such as typhoid fever, etc.

Administration.—Pilocarpine is best administered in the form of a solution, being far more reliable in its action than the extract. It is used in the treatment of nausea and vomiting. Pilocarpine may also be administered in the form of troches, although it is frequently administered in the form of a solution.

Of all the preparations of the drug, the infusion is commonly employed in the treatment of profuse salivation. An elixir of pilocarpine may be used if desired.

Should preparations of jaborandi be used in the treatment of the stomach, they are less apt to occasion profuse salivation. They may be also avoided by giving a small dose of pilocarpine.

Liquor Ammōnii Acetātis—Solution of Ammonium Acetate

(SPIRIT OF AMMONIUM ACETATE)

Origin.—An aqueous solution of ammonium acetate, together with small amounts of other salts.

Description and Properties.—A colorless, odorless, and tasteless liquid, of a mildly saline, aculeous taste and a specific gravity of 1.025. It should be freshly made.

Dose.— $\frac{1}{2}$ –1 fluidounce (15–30.0 Cc).

Official Preparation.

Liquor Ferri et Ammōnii Acetātis
Solution of Iron and Ammonium Acetate
under Preparations of Iron.

Antagonists and Incompatibles.—The metallic sulphates, the salts of lead and silver, lime-water, the carbonates of potassium and sodium, and acids.

Synergists.—Spirit of nitrous ether, potassium citrate, and many of the refrigerants and diaphoretics.

Physiological Action and Therapeutics.—Solution of ammonium acetate is both a mild diaphoretic and diuretic, according as the action is governed by other more powerful agents. For instance, if the skin is warm and the cutaneous blood-vessels dilated, the preparation acts as a diaphoretic, while if the condition of the skin is the reverse, the action of the drug is directed to the kidneys. Should the preparation be given with aconite or spirit of nitrous ether, its action would be that of a diaphoretic, but if the drug were associated with digitalis or squill, it would act as a diuretic. In any case the action of the drug is due to a stimulation of the secretory cells or nerves.

The principal medical use of solution of ammonium acetate is as a diaphoretic in febrile conditions, such as *acute coryza*, *influenza*, *acute pharyngitis*, etc. It is a very efficient remedy in *muscular rheumatism*, and in the *eruptive fevers* when the eruption is retarded. It is frequently associated with other remedies in the treatment of *scarlatinous droop*.

Owing to its property of stimulating the heart and circulation, the remedy has been recommended in low forms of fever, in the belief that it helps to sustain the powers of life, in lowering the pulse and temperature, moistening the tongue, and quieting the delirium.

In *migraine* and in *alcoholic intoxication* few remedies are so successful, the drug frequently dissipating the effects of acute alcoholism at once.

The remedy has been found efficacious in *dyshenœchia* and *menorrhœgia*, and has been employed externally and locally as a discutient in *mammary engorgements*, *glandular swellings*, *contusions*, *infectious abscesses*, etc.

Administration.—The preparation, as has been said, should be freshly made when wanted, and should be administered well diluted with sweetened water.

Spiritus Ætheris Nitrosi—Spiritus Ætheris Nitrosi— Spirit of Nitrous Ether. U. S. P.

(SWEET SPIRIT OF NITRE.)

Origin.—An alcoholic solution of ethyl nitrate, yielding, when freshly prepared and heated in a retort, not less than seven times its own volume of oxygen gas.

Description and Properties.—A clear, mobile, volatile, and inflammable liquid, of a pale yellow color, and a strong, fragrant, ethereal odor, pungent when first used, and a strong, burning taste. It should be kept in dark, well-closed bottles, remote from light and fire.

Dose.—℥ss to ℥ssss (2 to 5 cc.).

Antagonists and Incompatibles.—Potassium iodide, ferric sulphate, and tannic acid, of guaiacum, and gallic and tannic acids.

Synergists.—Diaphoretics, and aconite, potassium citrate, etc.

Physiological Action and Uses.—The solution of ammonium acetate is applied to the skin and allowed to evaporate, producing a slight anesthetic effect. It is more powerful than that of the ammonium acetate. It is more stimulant than the latter preparation, being a stimulant, stomachic, and carminative.

Like the solution of ammonium acetate, it acts either as a diaphoretic or as a stimulant. The manner in which it is administered should be given in ice-water and in diaphoresis its administration is continued until the patient drinks and the patient be well covered.

Spirit of nitrous ether is used in the solution of ammonium acetate in febrile affections to promote diaphoresis alone or in combination with tannic acid. It is given as a diuretic in *Bright's disease* and in painful affections of the urinary tract.

It is a serviceable remedy to allay nausea, and to relieve antispasmodic the remedy is fit for the pain of *dysmenorrhea*, and it may be used in *angina pectoris*. It enters into many experiments in application to the forehead in *neuralgia*.

Administration.—The dose of nitrous ether depends upon the nature of the case. In pyretic in febrile affections it is given in minims (1.30–2.0 Cc.), in sweetened water. To produce diuresis the drug should be given as a diuretic and given in larger doses, three or four hours. If the reaction is not produced, it should be given in hot water (1.3–2.0 Cc.), repeated every 15 minutes and covered.

Should the drug be given in large doses, it should not be less than 1 fluidram.

Care should be exercised in the use of nitrous ether that it be reliable and of fit quality. It has been kept in large bottles exposed to light and should be more or less inert and should

MINERAL ASTRINGENTS.

ASTRINGENTS are medicines which cause the contraction of living tissues, diminishing the amount of blood or other fluid in them, and reducing hemorrhage, or, through their constipating action, limiting the intestinal secretions as well as those from mucous membranes generally.

They act chemically upon the tissues, and when taken internally, their influence is similar to that of tonics, their principal use being in cases of relaxed conditions of the muscles and fibers or of the mucous membranes characterized by excessive secretion.

Astringents are more or less irritating, and should therefore not be employed, as a rule, in acute inflammatory conditions. There are, however, four exceptions—lead acetate or subacetate, bismuth subnitrate or subcarbonate, cerium oxalate, and silver nitrate—which are sedative astringents and would be indicated in acute inflammatory states.

Astringents are divisible into (1) mineral astringents, (2) vegetable astringents.

A large number of the heavy metals, while they have a profound influence on the nutritive processes, are not known to possess any beneficial action, but rather so depress metabolism as to be more harmful than useful. They are employed, however, very widely for their local astringent and antiseptic effects.

They are silver, copper, lead, zinc, aluminum, cerium, and bismuth.

The astringent and escharotic actions of all of the metals are prominent. Such actions depend, however, in the dissociable salts, upon both ions of the compound, the acid as well as the metal. From the standpoint of the metal they vary in strength of action widely, thus, the series from strongest to weakest, is: mercury, tin, silver, copper, zinc, iron, aluminum, and lead. For the acid ion, from most to least active, hydrochloric, nitric, sulphuric, oxalic, tartaric, citric, acetic acids. Thus, a combination of an active metallic ion, such as Hg with an active acid (cl), produces the very corrosive $HgCl_2$, corrosive sublimate, while lead acetate, the combination of the two mildest metal and acid ions respectively, produces a mild astringent salt. The chlorides of the heavy metals are usually soluble in water. Should a chloride be insoluble in water, it will not act as a caustic—as, for example, the insoluble, and consequently inert, silver chloride.

By a proper regulation, therefore, of acid and metal almost any grade of action may be brought about. Thus, for definite dilutions and concentrations those—

(1) Compounds that are mercuric acetate, zinc oxide, bismuth subnitrate, etc.

(2) Compounds that are astringent, such as zinc sulphate, zinc acetate, copper sulphate, etc.

(3) Compounds which are mercuric salts, zinc chloride, tin chloride, etc. Certain drugs which are caustic are, if sufficiently diluted, astringent.

An astringent drug employed *styptic*, as, for example, the subnitrate of iron.

Certain salts of iron are powerful astringents with iron under the Restorative Acids also possess marked astringent properties.

Inasmuch as many of these cause symptoms of chronic poisoning, they are given in greater detail.

Plūmbum—F

The salts of lead only are used in medicine.

Plūmbi Acētas—**Plūmbi Acetātis**
Lead Acetate—*Origin*.—Metallic lead is dissolved in acetic acid, and the lead oxide is dissolved by the aid of acetic acid.

Description and Properties.—Colorless plates, or heavy, white, crystalline mass, with a sweetish, astringent, and a metallic odor, and a sweetish, astringent, and a metallic taste. It is efflorescent and absorbing carbon dioxide. It is soluble in 3 parts of alcohol, in 0.5 part of boiling water.

Dose.— $\frac{1}{2}$ –5 grains (0.03–0.3 Gm.).

Liquor Plūmbi Subacetātis—**Liq. Lead Subacetate** (GOLLETT'S EXTRACT).—It contains not less than 25 per cent. of lead subacetate.

Liquor Plūmbi Subacetātis Dilūtus—**Diluted Solution of Lead Subacetate** (It contains 1 per cent. of lead subacetate).

Cerātum Plūmbi Subacetātis—**Cer. Subacetate** (GOLLETT'S CERATE).—*Uses*.—20, camphor, 2, wool-fat, 20, paraffin, 2.

Plūmbi Iōdīdum—**Plūmbi Iōdidi**—**Lead Iodide**.—by mixing a solution of lead nitrate and potassium iodide.

Description and Properties.—A heavy, permanent in the air. Soluble in about 1 boiling water, separating from the latter a crystalline laminae. Very slightly soluble in solutions of the fixed alkalis, in concentrated potassium iodide, and sodium hyposulphite. Lead iodide should be kept in a dark place.

Dose.— $\frac{1}{2}$ grain (0.015 Gm.).

Plūmbi Nitrās—**Plūmbi Nitrātis**—**Lead Nitrate**.—prepared by dissolving lead in diluted nitric acid.

Description and Properties.—Colorless, nearly opaque crystals, without odor and metallic taste. Permanent in the air. Soluble in alcohol. Used externally and locally.

Ploombi Oxidum—Ploombi Oxidi—Lead Oxide (U. S. P.) (LITHARGE)—Origin.
—Obtained by roasting lead ore.

Preparation and Properties.—A heavy, reddish or red-yellow powder of minute scales, without odor or taste. On exposure to air it slowly absorbs moisture and carbon dioxide. Almost insoluble in water and scarcely in alcohol. Soluble in acids or diluted water and also in warm solutions of the fixed alkalis. Lead oxide should be kept in well-closed vessels. (Used externally and locally.)

Emplastrum Ploombi—Emplāstra Ploombi—Lead Plaster (DIACHYLON PLASTER).—Used externally and locally.

(Lead cast-lead plaster is contained in emplastrum ammiacatum cum hydrargyro and emplastrum ferri, hydrargyri, olearum, and camphorae.)

Unguentum Diachylon—Unguenti Diachylon—Diachylon Ointment.—(Lead plaster, 50; olive oil, 49; oil of lavender flowers, 1.) Used externally and locally.

Physiological Action.—Lead *per se* is practically inert, some of its salts, however, particularly the acetate, possess valuable therapeutic properties.

Externally and Locally.—Applied to the unbroken skin, solutions of lead salts have little, if any, effect, yet they act readily upon denuded surfaces, blanching the tissue of the parts by contraction of the small blood-vessels. They coagulate the albumin of the protoplasm of the neighboring superficial cells, and the coagulum being insoluble in an excess of the lead salt thus forms a protective coating for the healthier structure beneath.

These salts have likewise a sedative action because of the decreased local circulation. The nitrate alone is irritating because of the nitric acid ion.

Internally—Digestive System.—Lead acts immediately in the mouth, causing a sweet, styptic taste and coagulating the mucus. It contracts the cells and vessels of the entire alimentary canal inducing dryness by diminished secretion. Consequent to the disturbed physiological functions of the digestive tract, the peristaltic movements diminish, and constipation necessarily ensues.

In small amounts lead salts have practically no action on the various cerebral or medullary functions. In chronic poisoning these are markedly affected.

Absorption and Elimination.—The preparations of lead are converted in the stomach into albuminates, and thence taken up by the blood, very little absorption taking place in the intestine, where the lead is converted into an insoluble sulphide. It is absorbed by the abraded skin, and enters directly into combination with the albumin of the tissues. A portion of the lead albuminate is eliminated by the liver with the bile into the intestine, where, being converted into a sulphide, it is excreted in that form with the feces. The skin, kidneys, and minitary glands assist in its elimination.

Excretion is very slow, the liver and kidneys retaining lead for a long time.

Uterus.—Under the influence of lead, abortion is liable to occur or the child be still-born.

Untersized Liver.—Undesirable results have followed the administration of medicinal doses of lead acetate, evidently arising,

from insufficient elimination. Butralgia, constipation, and paralysis. The last symptom occurred in the hand (0.06 Gm.) of lead acetate twice a day. In another case attack followed the exhibition of 4 grains three days. Tanquère des Plais an administration of lead prepared disagreeable symptoms. Hair d connection.

The external application of lead times produces unpleasant effect. In the mucous membrane lead ring, a single case being reported were applied to the eye. Gas repeated applications of such compounds ceasing with their withdrawal of the treatment. Colic and prolonged washing of a large ulcer symptoms disappearing upon a another case a sweetish, styptic the neck resulted from the external

Poisoning.—Acute poisoning fortunately, rare, the acetate—the emesis, thus preventing toxic effect.

The first symptom of poisoning soon followed by nausea and vomiting curdy material—the result of lead with the hydrochloric acid formation of lead chloride. Colic usually occur, with black passages by the sulphide of lead formed. Severe, persistent pain in the abdomen and contracted, while a retraction perceptible. There are great tenderness of the legs, neuralgic pain, stupor, anesthesia, and paralysis. Face is pale and the lips vivid. Pupils often diminished in size. The bowels becoming weak, compressible, and the acetate have caused death in

Treatment of Poisoning.—Emetics, the process being more or less of the drug. Some sulphate should form an insoluble lead compound the best antidotes, since they are retained; acting, moreover, as purgative. Opium will serve to relieve maintain bodily temperature hot feet and abdomen.

Chronic Poisoning—Chronic plumbism arises from a number of causes. The train of untoward symptoms is occasioned by long-continued medicinal use of lead preparations. Very frequent sources of poisoning are drinking water conveyed in lead pipes, and foods colored with chrome yellow and those contained in cans soldered with lead. It is especially liable to occur among painters (*colica pictorum*), manufacturers of lead salts, color grinders, and type-setters and founders. Hair dyes and cosmetics frequently cause lead-poisoning. Other sources are articles wrapped in tin foil, cheap camp outfits, forks, plates and spoons, some glazed earthen-ware.

The symptoms develop with comparative uniformity, affecting chiefly the (1) intestines, (2) blood, (3) kidneys, and (4) nervous system. (1) The intestinal symptoms are those of local irritation, anorexia, constipation, dark feces, occasional diarrheal attacks, mouth tastes bad, smells badly, dark discoloration about the teeth so-called lead line, particularly in those who do not keep the mouth clean. Colic usually develops after a short time—it often precedes a diarrheal attack. The intestinal spasms are exceedingly severe and come on with great suddenness.

(2) From the beginning there is an increasing grade of anemia. The red blood-cells degenerate, are pigmented, and the blood-making organs are also involved. The leucocytes may be increased or diminished. Pallor may become extreme.

(3) The kidneys almost invariably show granular degenerative changes. The urine is usually increased in amount, is of low specific gravity, usually contains albumin, granular and hyaline casts. The nephritis, originally parenchymatous in type, may become diffuse.

(4) The nervous symptoms are very variable. There is usually very early with the anemia and nephritis a persistent headache. The peripheral motor nerves are also affected and a multiple neuritis develops with extensive extensor paralysis. There is drop-wrist, drop-toe, etc. Usually bilateral, it may be unilateral. Pronation of the hand is possible, as the supinator longus is usually not involved in the paralysis. Sensory involvement is also possible. Anesthesia, paresthesia, sometimes neuralgic pains, occur. Arthralgias (gout-like) are not uncommon results of interference with the functions of the trophic nerves. Occasionally the nervous structures of the retina (amblyopia) are involved either as a result of the albuminuria or as a direct poisoning by the lead. The brain itself may become affected. Acute delirious states may be induced, or there may be hallucinations with mental confusion and dementia and convulsive seizures of an epileptiform nature.

Treatment of Poisoning—Removal of the poison is the first indication. The sulphates are given for their chemical and purgative effects, yet in chronic plumbism the hepatic purgatives—calomel, gamboge, jalap etc.—are often preferable. Opium and morphine relieve pain and spasms, being claimed by some authorities as spe-

cifics in lead-poisoning. Sulphur milk have been found beneficial. Doses, three times daily, has an effect detected in the urine after giving. It should be applied in suspected cases, and is alleviated by a diaphoretic, such as sweat.

In progressive paralysis, strychnine should be used to increase muscularization of the muscles, if they relax.

Therapeutics.—*Externally* and *internally* cal lead salt, its action will be first irritative as well as an astringent in acute (not chronic), *impetigo*, *lichen*, and is used stronger than 10 grains (O. S.) in water.

It is of service as an injection in *otorrhea*. In combination with opium application for *hemorrhoids*. As it is also serviceable in *orchitis*, *synchysis*.

Internally.—Its most important use in which use it is associated with opium is incompatible with that drug. It is used in *typhoid fever*, *yellow fever*, *hemoptoe*.

Morbid discharges, such as the *typhoid* and the *diarrhea of typhoid*, *dysentery* in *bronchorrhea*, and *serous diarrhea*. acetate of lead and opium, which tenesmus attending the respective morbid discharges, however, is in *serous diarrhea* quickly and efficiently, and being given in *chronic gastritis* with relief.

Given in *chronic gastritis* with relief.

LIQUOR PLUMBI SUBACETATIS.—Used for *bruises*, *sprains*, *acute ecchyma*, *erysipelas*, and all kinds of skin diseases well diluted. It also relieves the *itch*, and *eczema*.

A *felon* may sometimes be absorbed by saturating bread-crumbs with Glycerine, and placing it over the finger.

PLUMBI IODIDE.—Used very sparingly as an ointment applied to the *spleen*; also for *psoriasis* and *chronic eczema*.

PLUMBI OXIDUM.—Hebryre consists of parts of lead plaster and linseed oil chiefly used in the preparation of *trium saponis* and *emplastrum resinosum* oxide.

PLUMBI NITRAS.—Used with good results in *onychia* and also in the manufacture of Ledyne's disinfectant. It is an excellent remedy for *fissured nipples*, care being taken to wash the nipple before suckling. It destroys the *fetid odor* arising from *gangrenous sores* and *offensive discharges* from the *ears*, *nostrils*, *rectum*, and *vagina*.

Administration.—Locally a watery solution of lead acetate, 10 grains (0.64 Gm.) to 1 ounce (300 Cc.), is used. Powdered opium can be added, 1 dram to the pint of water. Applied to mucous membranes or used as an injection, 2 grains (0.12 Gm.) to 1 ounce (300 Cc.) of water, or 5 grains (0.32 Gm.) of the acetate and 5 grains (0.32 Gm.) of zinc sulphate in 1 ounce (300 Cc.) of water—rose water, for instance—proves a most efficient application. Suppositories for hemorrhoids may contain 1 grain (0.06 Gm.) of opium to 3-7 grains (0.19-0.32 Gm.) of the acetate. The *pilule plumbæ cum opio*—lead acetate 3 grains (0.19 Gm.), opium 1 grain (0.06 Gm.)—is mostly used internally, one pill being taken every three hours. In dysentery and cholera infantum an enema containing 5 grains (0.32 Gm.) of lead acetate to 1 grain (0.06 Gm.) of opium, or $\frac{1}{2}$ grain (0.03 Gm.) of morphine to 1 ounce (300 Cc.) of water, gives excellent results.

Should there be any abrasion of the skin, lead subacetate must not be used, as it prevents healing by constricting the edges of the wound.

Solution of subacetate of lead is most frequently used in union with opium, forming the well-known L. and L., or lead-water-and-laudanum, solution. It is also used in conjunction with glycerin, 1 ounce of each, or as Goulard's cerate, consisting of 20 parts Goulard's extract to 80 parts camphor cerate.

For ulcers, fissured nipples, and epithelioma lead nitrate is used, chiefly in the powdered form. In the nose, ears, vagina and rectum a douche 2-5 grains (0.12-0.32 Gm.) to 1 ounce (300 Cc.) of water is used. A solution of 10 grains (0.64 Gm.) to 1 ounce (300 Cc.) of glycerin or brandy is a very good application for sore nipples.

Zincum—Zinci—Zinc. U. S. P.

Origin.—Obtained by roasting the native zinc sulphide or carbonate, and reducing the resulting oxide with charcoal.

Description and Properties.—A bluish-white metal showing a crystalline fracture in breaking a specific gravity 7.14, melting when heated to 420° C. in a reduced atmosphere. It is soluble in dilute acids, and in strong acids it dissolves with evolution of hydrogen gas.

Metastasis occurs in the form of thin films or in irregular, granulated pieces, or moulded into thin pencils, or in a state of fine powder.

Official Salts

Zinci Actas—Zinci Acetatis. Zinc Acetate is obtained by dissolving zinc acetate in water and adding a solution of sodium acetate to the solution.

Description and Properties.—Solid, white, crystalline, granular, or in a finely lustrous, having a faintly acrid odor and an astringent taste. It is soluble in water, the solution being colorless and having a faintly acrid odor. It is soluble in 5 parts of water at 15° C. and in 1 part at 100° C. It is soluble in dilute acids.

Dose.—As a tonic, 1-2 grains (0.06-0.12 Gm.) 3 or 4 times a day. As an astringent, 10-20 grains (0.6-2.0 Gm.) but probably used extensively and locally [2 grains (0.12 Gm.) U. S. P.]

Dose.—As a tonic, $\frac{1}{2}$ –2 grains (0.03 to 0.6–2.0 Gm.); but principally used externally (U. S. P.).

Zinci Carbōnas Præcipitātus—**Zinc Carbonate**.—*Origin*.—Prepared by zinc and sodium carbonate, and drying the precipitate.

Description and Properties.—An impalpable chemical composition, without odor or taste; or alcohol.

Dose.—2–3 grains (0.12–0.18 Gm.).

Zinci Chloridum—**Zinci Chloridi**.—**Zinc Chloride**.

A white, granular powder or porcelain-like internally.

Zinci Iodidum—**Zinci Iodidi**.—**Zinc Iodide** or carbonate in hydriodic acid.

Description and Properties.—A white, granular, and metallic taste. Very deliquescent, becoming brown from liberated iodine. Zinc iodide should be kept in small glass stoppered bottles.

Dose.— $\frac{1}{2}$ –2 grains (0.03–0.12 Gm.). (U. S. P.)

Zinci Oxidum—**Zinci Oxidi**.—**Zinc Oxide** or carbonate in a crucible.

Description and Properties.—An amorphous, insoluble in water or alcohol. It should be kept in small glass stoppered bottles.

Dose.— $\frac{1}{2}$ –5 grains (0.015–0.3 Gm.).

Zinci Phenolsulphōnas—**Zinci Phenate**.— $Zn(C_6H_4(OH)_2)_2 + 8H_2O$, compound should contain not less than 99.5 per cent. $SO_3, Zn 1.4 + 8H_2O$.

Description and Properties.—Colorless crystals, odorless, and having an astringent, may become pink. Easily soluble in water to litmus.

Dose.—Average dose: 2 grains (0.12 Gm.).

Zinci Stéarās—**Zinci Stearātis**.—**Zinc stearate**, 50 per cent.

Zinci Sulphas—**Zinci Sulphātis**.—**Zinc sulphate**, granulated zinc in sulphuric acid, impurities.

Description and Properties.—Colorless, and having an astringent, metallic taste. Soluble in water and in 5 parts of glycerin, insoluble in well stoppered bottles.

Dose.—1–3 grains (0.06–0.18 Gm.); [15 grains (1 Gm.), U. S. P.].

Unguētum Zinci Oxidi—**Unguētum Zinci Oxidi**.—Use externally and locally.

Zinci Valeras.—See Valerian.

Antagonists and Incompatibles.—Compatible with the vegetable astringents, lime water, the sulphides, silver nitrate.

Physiological Action.—Externally, zinc salts resemble the lead salts, powerful astringents. They are. The chloride is exceedingly caustic, are mildly antiseptic and astringent.

Internally.—**Digestive System**.—slight degree, the carbonate and emesis, with but little nausea or

their effects are due to local action on the stomach. Central nervous action may play a part in the emesis.

The salts of zinc also act as astringents upon the gastro-intestinal mucous membrane. Dyspepsia, constipation, or diarrhea frequently follow its ingestion even in small quantities.

Circulation.—Zinc salts, when introduced into the circulation directly, cause a depression of the heart's action, resembling in that, as in other regards, the action of copper, with which metal its general effects are most closely allied. The blood-pressure is affected but slightly. The pulse is somewhat slow, especially just before death. With the blood, zinc forms new hemoglobin compounds (zinc-hemol).

Nervous System.—Zinc produces a depression of the central nervous system. When introduced intravenously, it may cause paralysis of the extremities.

Absorption and Elimination.—Zinc is taken up from the stomach and intestine and is found in largest quantities in the liver and bile. It is also found in the kidneys, pancreas, spleen, and thyroid. It is not held in the body in as stable a condition as the lead salts, and is less liable to bring about chronic poisoning. It is largely eliminated by the kidneys and bile. The salivary, milk, and intestinal secretions also eliminate some. In its passage through the kidneys zinc is an irritant, causing, in poisoning, a parenchymatous nephritis.

Intestinal Action.—3-5 grains (0.10-0.32 Gm.) have produced nausea and gastric oppression, while if the zinc salt reaches the intestines diarrhea results. When taken on a full stomach the salts form an insoluble albuminate which undergoes the regular digestive process.

Repeated small doses, 3 grains (0.10 Gm.), have produced gastric oppression, eructations, slight confusion of thought, dizziness, bodily exhaustion, thirst, gastralgia, vomiting, and diarrhea. Zinc dyscrasia may follow, characterized by obstinate constipation, emaciation, and anemia.

Poisoning.—Continued use or excessive doses of zinc will produce poisoning, with symptoms resembling those of lead poisoning.

Chronic Zinc-poisoning.—Among zinc workers there is a type of poisoning known as "*zinc-foundry fever*," or ague. The attacks frequently are acute. After pouring a mold the worker may have a sense of general distress, with backache and irregular muscular pains and lassitude. There is no disturbance of the pulse or of temperature. Shortly following this chill may develop, the pulse is increased to 100 or 120, and there are cough, pain in the chest, and headache. Profuse perspiration marks the climax of the attack, and the patient has labored sleep and recovers.

It is not improbable that the accompanying salts of arsenic and lead, always found in commercial zinc, are responsible, in part at least, for some of these symptoms.

Treatment of Poisoning.—Chemical antidotes are the bicarbon-

ates of soda and potassium. Fl are also beneficial. Morphine vomiting. Laxatives and potas assist in eliminating the zinc.

Therapeutics.—ZINC OXIDE ointment or powder is used in *ch* *sured nipples, anal fissure, ulcers,* with linseed oil the oxide has a drug has proved useful as an inje

Internally.—Associated with belladonna, it is very effective in *diarrhea of children*—and *dyscut*

It is a most excellent remedy *sweating of phthisis*, and also ser of *bronchorrhea*, although its us tion, since zinc is but sparingly s

The oxide is valuable in *gast*

ZINC ACETATE.—It is used o in *gonorrhea* and *leucorrhœa*. I collyrium.

ZINC SULPHATE.—*Externally* chiefly in *weeping eczema, pruriti* vice as a wash in *ophthalmia* and in *gonorrhea, leucorrhœa, vulvitis, greenous stomatitis, cancerum oris,* and *relaxed sore throat*. In *nasa* the solution being applied to the pus. It dries up soft tumors n urethra.

Internally.—Its chief use is th poison, irritating foods, and esp the air-passages are obstructed, i

It acts as an astringent in *ch* associated with opium and *ipeca*

ZINC CARBONATE.—This prep blisters, *weeping eczema*, and *int* of a powder, but generally as ar

ZINC IODIDE.—This salt is b as a *gonorrheal* injection, as an *rated tonsils*, and in *scrofulous gl*

ZINC PHOSPHIDE and **ZINC VI** benefit derived from the phosph properly be omitted here.

A long list of newer compou synthetic chemists. Some are employed with understanding. *chrysophanate, cyanide, gynoca fonate, permanganate, salicylate,* and *sulphocarbolate.*

Administration.—Externally the powder or ointment of zinc oxide is used, or the drug may be mixed with powdered starch, lycopodium, or acacia. Before applying these preparations it is well to wash the parts with a weak solution of carbolic acid.

Internally, $\frac{1}{4}$ grain (0.01 Gm.) zinc oxide and 3 grains (0.19 Gm.) sodium bicarbonate are given in diarrhea, or, if preferable, bismuth subnitrate 10 grains (0.64 Gm.), pepsin (Sheffer's) 3 grains (0.19 Gm.), and zinc oxide $\frac{1}{2}$ –1 grain (0.03–0.06 Gm.), with a little opium added.

As an injection a combination of 10 grains (0.64 Gm.) each of zinc sulphate and lead acetate is used, the two salts interacting and producing lead sulphate—which is precipitated and insoluble—and zinc acetate.

Locally and externally the dry powder of zinc sulphate is used, or a mixture of zinc sulphate 10 grains (0.64 Gm.), aqua rose 4 ounces (118.29 Cc.), and glycerin 1 dram (4.0 Cc.), as a lotion. As an injection it is associated with lead acetate, forming the zinc acetate and lead sulphate. In *ophthalmia neonatorum* zinc sulphate 5 grains (0.32 Gm.), morphine sulphate 3 grains (0.19 Gm.), and aqua rose 1 ounce (30 Cc.), perhaps with atropine added, form an excellent mixture.

Internally, in dyspepsia 1–2 grains (0.06–0.12 Gm.) may be given, and for intestinal affections 1 grain (0.06 Gm.) each of the sulphate, powdered opium, and ipecac three times daily. To produce emesis 5 grains (0.32 Gm.) are sufficient.

The collyrium consists of $\frac{1}{4}$ grain (0.03 Gm.) of the salt in 1 ounce (30 Cc.) of rose water.

COPPER.

Cûpri Sulphas—Cûpri Sulphâtiſ—Copper Sulphate. U. S. P.

Origin.—Prepared by heating copper and sulphuric acid together, dissolving the residue in distilled water, and evaporating.

Description and Properties.—Large, transparent, leaf-like, crystals, soluble in a moderate quantity of water, more soluble in hot water. Soluble in about 20 parts of water at 60° F. (15.5° C.).

Dose.— $\frac{1}{4}$ grain (0.03 Gm.) to 1 grain (0.06 Gm.) 3 or 4 times a day. As an astringent, at 40° F. (4.4° C.), 2 to 5 grains (0.12 to 0.32 Gm.) (4 grains (0.26 Gm.) 1 to 1½).

Antagonists and Incompatibles.—Alkalies and their carbonates, the sulphides, mineral salts (except the sulphates), lime water, the iodides and vegetable astringents.

Physiological Action.—Copper sulphate is the salt mostly used, and the only official preparation. Its action is therefore given as characteristic of that of cuprum.

Externally.—Applied to the unbroken skin it produces little effect, but on raw surfaces or mucous membranes it acts as an astringent. In large quantities it acts as a caustic. It also possesses antiseptic properties.

Internally.—Digestive System.—It acts as an irritant, causing

vomiting of greenish matter, the emesis. The secretions are augmented of blood and mucus are attenuated. Should emesis be delayed, the stomach should be emptied, otherwise the copper will be absorbed.

Circulatory System.—Copper acts as a tonic, being present in the blood. It stimulates the heart, or, as Kobert describes, a new force presses the heart's action, causing a more rapid circulation.

Nervous System.—It acts as a stimulant.

Respiratory System.—Its influence is on the respiratory movements.

Absorption and Elimination.—Copper is absorbed, tending to accumulate in the liver, kidneys, salivary glands, and the skin.

Poisoning.—Acute poisoning is caused by inhaling cupreous fumes, eating fruits covered with a copper salt.

When inhaled the first symptoms are coughing, sneezing, and irritation. Internally administered, the symptoms appear at once, but after an hour a strong metallic taste in the mouth, inflammation of the pharynx and fauces, salivation and purging, the passages alter a while, and the blood is discolored. There are present also griping, colicky pains.

Copper enters the circulation. A characteristic symptom of poisoning is jaundice. Sometimes jaundice may be preceded by a suppression of urine, cardiac depression, and other symptoms among the graver symptoms.

Treatment of Poisoning.—A characteristic antidote is at once, potassium ferrocyanide to be given. It is a soluble copper cyanide. Other remedies are sweet oil, emetics, and the use of a blister. A plaster, with a little opium added, may be applied over the pit of the stomach. Should vomiting have already occurred, it should be induced.

Chronic poisoning is thought to be caused by the use of the medicine or from taking much of the metal in the many foods that are treated with it. The symptoms are described the same as in the acute poisoning, the following superadded: paralysis of the muscles, atrophy of the liver-cells, and proliferous degeneration of the kidney, together with a general debility. There may also be present congestion of the kidney, together with a general debility. It means certain that these symptoms are caused by lead and arsenic, which are so

ticularly in foundries, etc., where these symptoms are noted. In view of the value of copper as a general disinfectant, the metal and its salts being markedly bactericidal, the question of chronic poisoning merits detailed investigation.

Therapeutica.—*Externally and Locally*—COPPER SULPHATE stimulates *old, flabby, granulating ulcers*. *Ringsworm, scabies*, and *tinea syvens* derive great benefit from its use.

The crystal or solution, 2 grains to 1 ounce (0.12-32.0 Gm.) of water, is used extensively in *conjunctivitis, trachoma, and trachoma condylomata*, and as a gargle in relaxed *sore throat*. The aphthae in *aphthous stomatitis* are benefited by touching with the copper sulphate solution. It is also used as an injection in *gonorrhoea* and *gleet*, 2 grains to 1 ounce (0.12-32.0 Gm.). It is also valuable in *mercurial sore mouth* and *gangrene of the pharynx*.

Internally—COPPER SULPHATE is the chemical antidote for phosphorus-poisoning, yet it should be given with great caution, lest of itself it produce acute poisoning. It is a speedy emetic, since it acts directly upon the stomach. If emesis is not produced by the first dose, sulphate of zinc or mustard may be employed. It is used as an emetic in *croup*.

In *chronic dysentery and diarrhoea* an enema of a pint of water (512.0 Gm.) and 10 grains (0.64 Gm.) of sulphate of copper is an efficient remedy, being by some authors considered the best metallic astringent in *chronic dysentery*.

Copper associated with arsenic is highly beneficial in *anemia*.

OXYD OF COPPER is used in the skin affections mentioned.

NITRATE and ACETATE OF COPPER act like the sulphate.

ARSENITE OF COPPER has been suggested as a remedy in *anemia*, and has been used in doses of $1\frac{1}{2}$ grain (0.0006 Gm.) in *diarrhoea* and *cholera infantum*.

Administration.—For an enema in diarrhoea and dysentery it may be combined with opium—2 grains to 1 ounce (0.12-32.0 Gm.) of water being used. For eye affections the crystal or solution is employed. In addition to the enema, copper sulphate, 1 grain (0.06 Gm.), may be united with magnesium sulphate 1 ounce (32.0 Gm.) and 1 dram (4.0 Gm.) of diluted sulphuric acid in 4 ounces (128.0 Gm.) of water, a tablespoonful of the mixture being given every three or four hours. To produce emesis 10-15 grains (0.6-1 Gm.) are dissolved in about 5 ounces (160.0 Gm.) of water, a tablespoonful being given every ten minutes until vomiting is produced.

REVER

Argentum Cyanidum Argentum Cyanidi—Silver Cyanide. U. S. P.

Origin.—Obtained by adding a solution of potassium ferrocyanide to a solution of silver nitrate, the mixture being allowed to stand until a white precipitate has formed. The precipitate is then washed with distilled water and

dried. It should contain not less than 90 per cent of metal corresponding to 80.48 per cent of metallic silver.

Description and Properties.—Insoluble in dry air, but gradually turning water alcohol, or cold nitric acid, soluble solution of sodium hyposulphate or potassium cyanide. Amber colored vials, protected from light.

Argēnti Nītras Argēnti

U.

Origin.—Obtained by dissolving silver nitrate, and crystallizing.

Description and Properties—
talc, becoming gray or grayish black on exposure.
Without odor, but having a bitter, caustic,
part of water and in 20 parts of alcohol.
via s., protected from light.

Dose.— $\frac{1}{4}$ to 1 grain (0.015–0.06 Gm.)

Official F

Argent Nitras Mitigatus—Argent
trate (MITIGATED CALSHE).—Dose.—

Description and Properties. A white, or cores of a finely granular fracture, becoming light in the presence of organic matter; neutral to litmus-paper. It should be externally,

Argentī Nitras Pūsus—Argentī
(LUNAR CAUSTIC) —*Origin.* —Obtained
acid, 4, and pouring the melted mass into

Description and Habitat.—A white of a fibrous texture, becoming gray or green of organic matter, tasteless, having a bitterish in the part of water and in 20 parts dark, amber-colored water, protected from

Argēnti Ōxidum—Argē

五

Origin.—Prepared by shaking a solution of the acid with water and washing the precipitate.

Description and Properties.—to reduction by exposure to light, odorless in water and insoluble in alcohol.

Dose.— $\frac{1}{2}$ 2 grains (0.03–0.12 Gm.)

Antagonists and Incompat
patible with the alkalis and h
chloric and tannic acids, potassi
many of the organic acids.

Silver oxide is rapidly oxidized with chlorides and organic substances.

Synergists.—Preparations of action of silver salts.

The silver nitrate and its pr
the only salts which possess at

The silver nitrate is the typical astringent salt, and its physiological action will be hereafter considered.

Physiological Action.—Metallic silver is practically of no use in medicine, though of great value in surgery, because of its inertness. Silver nitrate is the salt of silver chiefly employed.

Externally and Locally—It is a powerful caustic, but does not wound very deeply, as it forms an eschar by coagulating the albumin of the tissue, thus protecting the underlying structures. The eschar is white, but on exposure to light very soon becomes black, owing to the fact that the silver is reduced to its metallic state. The albuminate is soluble in chloride.

Like lead salts, silver salts are hemostatic. They are severely irritant to mucous membranes when used in solution. Soluble silver salts are actively bactericidal.

Internally—Digestive System—Weak solutions are astringent to mucous membranes, first contracting then dilating the blood-vessels. Stronger solutions are caustic. Weak solutions cause increased secretion of intestinal glands and larger flow of bile. The nitrate is frequently precipitated as the insoluble chlorides in the stomach and is later absorbed as an albuminate.

Silver salts have little or no action on the general functions of the body.

Absorption and Elimination—It is absorbed from the stomach and eliminated very slowly, chiefly by the testes, a small portion being excreted by the kidneys.

Internal Action—Long continued use of silver nitrate produces discoloration of the skin (argyria), either general or more pronounced in particular spots, such as the face. Even when the skin is perfectly intact the application of nitrate of silver will discolor it, and $\frac{1}{2}$ grain (0.06 Gm.) has caused palpitation of the heart and irregular pulse. Silver accumulates in the tissues.

Poisoning—A poisonous dose of silver nitrate produces a violent gastro-enteritis. The earliest symptom is an intense pain in the abdomen, followed by vomiting and purging. The abdominal muscles are hard and retracted, the face livid and covered with perspiration and wearing an anxious expression. The lips are blanched, gradually becoming black; the vomited matter is blackish and sometimes resembles milk-curd.

Epileptiform convulsions, delirium, and paralysis ensue, the latter symptom being of centric origin.

Death results from shock. A large amount of mucus is thrown into the bronchial tubes by the living mucosa.

Treatment of Poisoning—The chemical antidote is common salt. It is essential to protect the mucous membrane of the esophagus and stomach, and at the same time dilute the poison as much as possible, for which purposes large quantities of salt water and soap water or milk are valuable. Opium allays the pain and irritation.

Chronic Poisoning, or argyria, results from prolonged medicinal use of silver nitrate or its employment as a hair-dye for any length

of time. The drug is deposited especially manifest in a slaty, per. The first symptoms are discoloration and a dark line on the inner side may occur, or even gastric ulcer.

Treatment of Chronic Poisoning.—of curing argyrosis when once 10 grains seem the limit. If more given the discoloration is apt to variation exists. Localized argy after continued local application and pharynx.

Therapeutics.—*Externally* an of SILVER NITRATE is that of 1 per cent. solution being dropped to 4 per cent. solution is used in eyelids being painted with a car being washed off immediately to 10 grains of silver stick may also be used.

Felons, boils, and bedsores in use of a strong solution—20 grains

An injection of 2–3 grains (.1–.3 Gm.) in *subacute gonorrhea* and *leucorrhea* a wash in *pruritis ani* and *eczema*, may be applied to *uterine ulcers*.

As a caustic it is used in *indurated* them and producing a hea

After a cold, when the throat of 10 grains (0.6 Gm.) to the and the same may be used in *inf* and *mouth*. A spray of 10 grains (Cc.) is very effective in *laryngeal* of the *larynx*, and *whooping-cough*, *tonsillitis*, *sore nipples*, *mercurial* and *punctured wounds*. A solution the ounce (30.0 Cc.) is valuable in *balanitis*.

Internally.—Dr. Pepper recommends *recorations*, given in keratin-coated pills in which it may be combined with *gastritis*, *ulceration of the rectum*, have been remarkably benefited by $\frac{1}{4}$ – $\frac{1}{2}$ grain (.01–.016 Gm.) is given 3–10 grains (.20–.64 Gm.) to the

It has been used in congested *ataxia*, *epilepsy*, and *chorrea*. It is in these conditions.

ARGENTIC OXIDE is not so employed for checking *sweats*,

action, it may be preferable to the nitrate in *gastric ulcer* and *gastralgia*.

Administration.—The dose of silver nitrate is $\frac{1}{2}$ – $\frac{1}{4}$ grain (0.1–0.16 Gm.), and for a constitutional effect should always be given in pill form during the process of digestion.

The keratin-coated pill is to be administered for intestinal disorders, and when a local action on the alimentary canal is desired an ordinary pill should be given one to two hours before meals.

It is well to discontinue the drug for a short time after three or four weeks' treatment, the salt being so slowly eliminated that its prolonged use is very apt to result in argyria.

Newer Preparations of Silver.

Within recent years a number of new compounds of silver have been placed on the market. These have been devised to obviate, in part, the irritating effects of silver nitrate, as well as to avoid the limited action of this drug because of its property of coagulating proteins. Further, in internal therapy, since chlorides form insoluble compounds, these newer bodies have been made to avoid this chemical change. Among the more important of these may be mentioned *Argentol*, *argem*, *argentamin*, *protargol*, *largin*, *actol*, *argol*, *whithyrgon*, and *colloidal silver* (*collargolum*).

Argentol.—This is a synthetic compound of *yo-naseptol* and silver, which breaks up into cyanides and metallic silver. It is non-toxic, and is as effective as silver nitrate when introduced, and has been employed in gonorrhea, but is not so effective as protargol for this disease.

Argem.—*Chemical.*—A soluble compound of silver and casein, first prepared by Rohmann and Latschsch.

Preparation and Properties.—A dilute solution of this substance in water is opacified (opaque when concentrated), but not clearly altered by the addition of ammonia or carbonate of soda. Used externally and internally.

Argentamine.—In order that a deeper action of silver might result, this solution of silver phosphate in aqueous solution of ethylamine was prepared. It was found, however, that the amine was too irritating, and this preparation has had limited application.

Protargol.—This product is the result of the attempt to obtain a compound of silver with an organic substance of albumen, which should be soluble and water-soluble, and yet have the strong bactericidal properties of the metallic silver. It is a cream powder, readily soluble in water, and contains 5 per cent of silver. The substance is not affected by heat, alcohol, hydrochloric acid, sodium chloride or sodium iodide. It is not negatively irritating, and has proved one of the best agents in the treatment of gonorrhea yet given to the patients. It is employed in from 2 to 10 per cent solutions, depending upon the irritability of the affected parts and the stage of the disease.

Largin.—This is a compound of much the same character as protargol, being silver combined with protein. It is a white powder, a permanent emulsion, cream-colored fluid. This compound emulsion is a gray powder, soluble in 2 parts of water, containing 1 per cent of silver, and is not precipitated by chloride ion or by albumen. It is used in much the same manner as protargol. It is soluble in 100 parts of solution.

Actol.—This is a lactate of silver, a white powder, soluble in water, and soluble in 20 parts of water. It has been recommended as an emulsion, and is in much the same manner that silver nitrate does.

Argol.—This is similar to actol, being the lactate of silver. It is much less soluble in water (1 grain). It has no advantage over the nitrate.

Whithyrgon is a combination of silver and albumen. Its position in therapy is not yet established.

Colloidal Silver (Collargolum).—Prepared by Cr  le as an antiseptic in 1898. By the conversion into a soluble form making, with which is used in internal hypodermic medication—silver is made up as an ointment.

The ointment should be rubbed into a sore. It has been highly praised for the treatment of *erysipelas*, *puerperal fever*, or other septic infection. The results are said by its supporters to be due to the silver.

Much more extended observation is desirable before any definite conclusions can be drawn concerning the value of colloidal silver when freshly made.

ALUM

Al  men—Al  min

Origin.—Prepared by a complicated process of roasting, leaching, and filtering, while hot, mixing with potassium chlorid crystalline powder, which is purified by obtaining not less than 99.5 per cent. of pure alumina, Al_2O_3 .

Description and Properties.—It is obtained by cubes, or crystalline fragments, and strongly astringent taste. On exposure to ammonia and acquire a whitish coating. Boiling water, also freely soluble in warm water.

Dose.—5–40 grains (0.3–2.60 Gm.); 1 grain (0.05 Gm.), U. S. P.].

Official Preparation

Al  men Exsiccatum—Al  minis Bala.—Alum heated until it is deprived of water.

Description and Properties.—A white, granular, sweetish, astringent taste and attracting moisture. Completely soluble in 20 parts of water, and quinine.

Dose.—1–5 grains (0.06–0.3 Gm.).

Al  mini Hydr  xidum—Al  minum Hydroxide

Origin.—This substance is found in nature of North America—the *al  min* of East India. It is prepared by precipitating the solution of alumina with caustic soda.

Description and Properties.—It is a white, tasteless, permanent in dry air. Insoluble in hydrochloric or sulphuric acid. T. S.

Dose.—3–6 grains (0.2–0.4 Gm.).

Al  mini Sulph  s—Al  minum Sulphate.

Origin.—It is occasionally found as a mineral. For medicinal use it should be dissolved in the requisite quantity of dilute acid.

Description and Properties.—A white, tasteless, astringent taste, peroxide of iron, and much more freely in boiling water.

Alled Compounds.

Alumol. **Alumol.** **Alumol.** *Origin.* This substance was discovered by Pilsch at Breslau and is a mixture of ammonium salts of tartaric sulphonic acid, containing about 5 per cent. of aluminum and 14 per cent. of nitrogen.

Description and Properties.—It occurs as a light, colorless, white or reddish white, non-hygroscopic powder. It possesses a sweetish and astringent taste, and is readily soluble in water or glycerin, less so in alcohol, and insoluble in ether.

While becoming darker on exposure to the air, its properties are unaffected. Used externally and locally.

Aluminum Aceto-tartrate. *Origin.*—First prepared by Stenstedt by dissolving 5 parts of basic aluminum acetate in a sufficient quantity of water by the aid of a purified tartaric acid and evaporating the solution to dryness.

Form and Taste.—It occurs in the form of almost colorless, amorphous masses with a faint, acetous odor and an astringent taste. Soluble in water, insoluble in alcohol. Used externally and locally.

Aluminum Boroformate. *Origin.*—Prepared by heating together boric acid, formic acid and alumina.

Other combinations of aluminum are: *Alid* (acetate), *Borid* (borotartrate), *Cutid* (borotannate), *Gallid* (gallate), *Sodal* (aluminum hydrate, dissolved in phenylsulphonic acid), *Salicamin* (salicylate), and *Tannal* (tannate). They have the same indications as alumol.

Antagonists and Incompatibles.—The alkalis and their carbonates, lead, mercury, and iron salts, tartrates and tannic acid.

Synergists.—The vegetable and mineral astringents.

Physiological Action.—*Externally and Locally.*—Alum contracts the small bloodvessels and coagulates the albumin in the tissues, but in order to have any effect it must be applied to a denuded surface. It is also mildly escharotic, particularly if anhydrous. The albuminate formed is soluble in an excess of protoid. Applied to the unbroken skin, it thickens and hardens it.

Internally.—Digestive System.—Its first effect when taken into the mouth is to excite the salivary secretion, the albumin in it, as well as that of the buccal mucous membrane, being precipitated. When its astringent action takes effect the secretions are diminished and the mucous membrane of the mouth and tongue is blanched and puckered. The enamel of the teeth is affected, breaking under its influence.

The digestive juices are diminished in quantity and the pepsin precipitated. Constipation follows, though it may be preceded by a slight diarrhea.

Taken in large doses, alum produces nausea, vomiting, purging, and abdominal pain.

Under ordinary conditions aluminum salts have no action on the general functions. Thrown into the circulation hypodermically they have a profound influence on the nervous structures, but such results are of experimental interest alone.

Absorption and Elimination.—As stated, alum is absorbed by the stomach and intestines, it is eliminated by the kidneys and liver.

Unusual Action.—The prolonged use of alum is very apt to produce a cough in persons having sensitive bronchi.

Therapeutics.—*Externally* an astringent, destroys *exuberant granulations* and is hemostatic in *epistaxis* and bleeding from *bladder, bites, and sockets of extra*

It is much used for *sore throat* and is also efficient in *tonsillitis, gangrenous pharyngitis, stomatitis, and pharyngeal mucous membrane* and *mercurial ptyalism*.

The destructive effect of alum is borne in mind: the alum stick is used as far as possible. If a mouth-wash or gargle is used, the teeth well immediately after.

Five grains (0.32 Gm.) to 1 ounce of water is a good preparation for *ophthalmia*, must not be used if there is any tendency to cause ulcers. By adding milk its efficiency is greatly increased. It is serviceable in preventing the discharge in *gonorrhea*. Injection of 5–10 grains (0.32–0.64 Gm.) in water is much used in *gonorrhea* for washing the vulva in *pruritus*.

Sweating of feet, hands, and face is checked by the application of a solution.

Soaking a piece of cotton or lint in a solution of alum and applying it to an *ingrowing toe-nail* affords material relief.

Chilblains, old sores, and ulcers are cured by alum.

A spray, gargle, or insufflation of alum is used in *diphtheria, bronchorrhea, chronic bronchitis, and whooping-cough*.

Internally.—ALUM operates as an astringent, arresting *gastric and intestinal hemorrhages*. The *diarrheas of typhoid fever*, and occasionally the acute forms, are cured by it.

By checking absorption and acting as an antidote for *lead-poisoning*, and *arsenic poisoning*.

ALUMEN EXSICCATUM is employed to destroy fungous growths, and to stimulate the membranes with morbid secretions.

Whenever the drug is used as an astringent, powdered dried alum is the best form.

Administration.—The emetic dose is 10 grains (0.64 Gm.) (4.0–8.0 Gm.) in syrup. Warm water or tea retching begins.

For internal use, 5–10 grains in little simple syrup or syrup of orange is to be found beneficial. For collyrium, 1 ounce (30.0 Cc.) of water, or the

may serve best. The curd may be separated by adding 2 drams (8.0 Gm.) of alum to 1 pint (473.0 Cc.) of milk, boiling, and straining.

The gargle and injection can be used in strengths of 5-20 grains (0.32-1.29 Gm.) to 1 dram (4.0 Gm.). For insufflation the dried alum is employed.

BISMUTH.

Bismûthi Citras—Bismûthi Citrâtis—Bismuth Citrate. U. S. P.

Origin.—Bismuth sub-nitrate and citric acid are boiled in sufficient water and the precipitate washed and dried. It should contain not less than 55 per cent but more than 60 per cent of pure bismuth oxide.

Description and Properties.—A white, amorphous or microcrystalline powder, odorless and tasteless, permanent in the air. Insoluble in water or alcohol, but soluble in ammonia water and in solutions of the citrates of the alkalies.

Dose.—1-3 grains (0.06-0.2 Gm.) [2 grains 0.125 Gm., U. S. P.]

Official Preparation

Bismûthi et Ammônii Citras—Bismûthi et Ammônii Citrâtis—Bismuth and Ammonium Citrate. *Official.* Prepared by mixing bismuth citrate with distilled water to make a paste adding sufficient ammonia water to make a solution, filtering, evaporating and drying in glass.

Description and Properties.—A white or pale yellowish white powder, with a slightly acidulous and metallic taste, has strong opacities on exposure to the air. Very soluble in water, but sparingly soluble in alcohol. The product should be kept in well-stoppered bottles, protected from light.

Dose.—1-20 grains (0.06-1.3 Gm.) [2 grains 0.125 Gm., U. S. P.]

Bismûthi Subcarbōnas—Bismûthi Subcarbonâtis—Bismuth Subcarbonate. U. S. P.

Origin.—Obtained by dissolving purified bismuth in nitric acid and water, decanting and filtering, treating with ammonia water, washing the precipitate, and drying in water and alcohol. The mixture contains mixed with a compound sodium impurity and the resulting precipitate collected and washed. It should yield not less than 90 per cent of pure bismuth oxide.

Description and Properties.—A white or pale yellowish white powder of somewhat varying chemical composition, odorless and tasteless, permanent in the air. Insoluble in water or alcohol, but comparatively soluble in nitric or hydrochloric acid, with copious effervescence.

Dose.—3-30 grains (0.2-2.0 Gm.) [7½ grains 0.5 Gm., U. S. P.]

Bismûthi Subgallas—Bismûthi Subgallâtis—Bismuth Subgallate. U. S. P.

Definition.—Bismuth subgallate should yield not less than 52 per cent but more than 57 per cent of pure bismuth oxide.

Official.—In the German Pharmacopœia as Bismutum Subgallicum, also known as *der Bismut*.

Description and Properties.—Although somewhat variable in chemical composition, bismuth subgallate approximates the formula $\text{Bi}_2\text{O}_3 \cdot 3\text{H}_2\text{O} \cdot 3(\text{C}_6\text{H}_4\text{O}_7)$, which contains 74.4 per cent of bismuth oxide. Light, amorphous bright yellow powder, odorless, tasteless, and permanent in the air. Insoluble in water, alcohol and in very dilute nitric acid. Becomes soluble with decoloring power in hydrochloric, nitric, and sulphuric acids if these be heated. Absorbs the same if heated, forming clear, yellow-colored solutions, which rapidly change to deep red.

Dose.—Average dose 4 grains (0.250 Gm. = 250 milligrammes, U. S. P.)

Bismūthi Subnitrās— Bismuth Subn

Origin.—Prepared by dissolving and concentrating by evaporation, adding more of the precipitated bismuth subnitrate. It is bismuth oxide.

Description and Properties.—In its chemical composition, odorless and almost insoluble in water and insoluble in alcohol and acid.

Dose.—5–20 grains (0.3–1.2 Gm.) [1]

Bismūthi Subsaliçylās— Bismuth Subsa

Definition.—Bismuth subsalicylate contains more than 64 per cent. of pure bismuth oxide. Official under the names of Bismutum salicylicum (Swiss), Bismuthi salicylicum (Br. P.), approximately $C_6H_4(OH)(CO_2)BiO$.

Description and Properties.—Crystalline powder, odorless, tasteless, and insoluble in water; on prolonged boiling with water splitting off of free salicylic acid. Also decomposition of the salt. Acids decompose precipitate of salicylic acid.

Dose.—Average dose: 4 grains (0.26

Unofficial Bism

A large number of bismuth compounds have appeared in the last few years. The following may be mentioned: oxydodibismuthate, bismal (bismuth and sodium phosphate salicylate), erurin (quercetin bismuth oxydide methyl gallol), bismalate (bismuth oxydide methyl gallol), the cresolate, the lactate, phenolbismuthate, the tannate, and similar compounds with resorcin, pyrogall

Bismuth Naphtholate.—Dose, 15–30

Bismuth Tribromphenate.—Dose, 6

Dermol Bismuth (Chrysophanate)—A yellow powder, neutral in reaction, locally.

Thioform.—A combination of bismuth

Description and Properties.—A light gray powder, insoluble in water, alcohol, or ether. Used

Xeroform.—Tribromphenolate of bismuth, a yellow, neutral, insoluble powder, tasteless in doses of 8–15 grains (0.5–1.0 Gm.) as a disinfectant in wounds, in gynecology, and in eczema and

Orphal.—Beta-naphthol bismuth, contains 23 per cent. of beta-naphthol. It is a light gray powder, insoluble in water and alcohol, but soluble in the intestines into bismuth and bismuthic acid in doses of 8–45 grains (0.5–3.0 Gm.)

Eudoxin.—This is a bismuth salt of oxalacetic acid, used as xeroform.

There is a long list of other bismuth combinations, some of which may be found, after further observation, to be of service.

Antagonists and Incompatibles—The salts of bismuth are insoluble, and should not be prescribed with other agents in solution.

Synergists.—The sedative action of bismuth upon the stomach may be increased by calomel and cerium oxalate, and pepsin may be given as a substitute for this purpose. The astringency of the bismuth salts may be enhanced by the addition of opium and tannic acid.

Physiological Action—*Externally*—Bismuth salts are mildly astringent, but have no appreciable physiological effect upon the unbroken skin.

Internally.—**Digestive System**—Bismuth is insoluble in the gastro-intestinal juices. It coats the mucous membrane, lessening secretions and absorbing excess of free acids, at the same time acting as a sedative and feeble astringent. The tongue and stools are tinged a dark clay color, due to conversion into the sulphide. The soluble salts are absorbed very slowly, and increase the appetite and digestion, constipation being the result.

In its general action bismuth is of interest only experimentally. In mammals intravenous injections of soluble salts cause slowing of the heart action, acceleration of the respiration, and irritative phenomena of the nervous system (convulsions).

Absorption and Elimination—The salts of bismuth are absorbed into the circulation, and are eliminated by the urine, liver, and feces.

Unfavorable Action—Others noticed nausea, and Weensck vomiting, colicky pains, diarrhea, or constipation, headache, sensation of heat, dizziness, and general debility.

Poisoning—It has always been assumed that cases of poisoning are due to the lead and arsenic contained in the bismuth preparations, and few cases of poisoning are known from the internal use of bismuth. Local applications (dermatol) have given rise to gastro-intestinal irritation—salivation, sore gums, smarting in the palate, etc. These symptoms disappear on removing the dressings.

Therapeutics.—*Externally and Locally*—Bismuth's carbonate is serviceable in *intertrigo*, *erythema*, *acute rosacea*, as a protective dressing for *wounds*, *ulcers*, and *epithelioma*, and as an application for *chapped nipples* and *hands*, relieving the smarting and itching. It is also of use in *furuncles*, *pyoderma*, and *superficial burns*.

It is used as an injection in *gonorrhea*, *leucorrhea*, and *gonitis*, and was formerly used as an insufflation in *acute nasal catarrh*, being abandoned because of the arsenic which it sometimes contains. It serves as a wash in *apathetic stomatitis*, mild cases of *mercurial salivation*, and *cantharidin* eruptions, as well as for the fetid sweating of feet and other parts and for *chancres* and *pharyngeal eruptions*. It has also proved beneficial in *chronic conjunctivitis* and *granular lids* or *trachoma*.

Internally.—It allays irritation, *irritative vomiting and diarrhea*. It is valuable in *pyrosis, chronic dysentery, diarrhea of typhoid, and infantum*, and in the *gastritis duodeni*.

THE CITRATE OF BISMUTH AND POTASSIUM should be used only for local applications.

THE OXIDE is insoluble, and is used as a snuff in *ozena* and *nasal catarrh*.

SUBCARBONATE OF BISMUTH is used as an antiseptic.

SUBSALICYLATE OF BISMUTH is used in *typhoid fever*, and also corrects *acidities*.

BISMUTH SUBGALLATE, or *Diachylon*, and Liebreich, being intended as astringents, is very astringent, although not so as *alum*. It is used in *weeping eczema, otitis media, and dysentery*. In *stagnant ulcers* it stimulates.

BISMUTH CITRATE is insoluble.

Besides the foregoing preparations, BISMUTH, used to some extent in *ophthalmia*.

PHOSPHATE OF BISMUTH is the most common compound, and is used, but rarely, in *gastralgia*, and *dyspepsia*.

SUBIODIDE OF BISMUTH is used in *strabismus*, and is of special value in *chronic conjunctivitis*, slightly anesthetic.

SUBGLENZOATE OF BISMUTH is used in *ophthalmia*.

Administration.—The drug is given in ointment in combination with a little morphine may be added. In *gastralgia*, bismuth are also used.

For *gastralgia* and *dyspepsia*, bismuth phosphate may be combined with *peppermint*, *rhubarb* may be added.

Bismuth, aromatic powder, a combination in flatulent *dyspepsia*.

In infantile diarrhea and subacute *typhoid*, (0.06 Gm.), *syrupus aurantii* 15 minims (0.92 Cc.) are efficacious in alternating pain. Large quantities are given.

Bismuth, 5–15 grains (0.32–1.0 Gm.) in *gastritis*, and 15 grains (1.0 Gm.) in *dyspepsia*, one to two hours after meals.

CERUM.

Cērii Ōxalas—Cērii Oxalātis—Cerium Oxalate.
U. S. P.

(CERUM OXALATE)

Definition—Cerium oxalate consists chiefly of a mixture of the oxalates of cerium, didymium and lanthanum, and of other rare metals of this group.

Origin—Prepared by a complicated process by the action of acids, etc., upon the powdered mineral.

Description and Properties—A white granular powder, without odor or taste and, estranged in the air. Insoluble in water, alcohol or ether.

Dose.—1-5 grains (0.06-0.5 Gm.) (1 grain = 0.065 Gm., U. S. P.)

Physiological Action—The physiological action of this drug is imperfectly understood: it is supposed to be a nervous and gastric sedative.

Therapeutics.—*Internally*—Its widest application is in the vomiting of pregnancy, but it also controls the emesis of uterine disease and of dyspepsia, due to gastric acidity or deranged innervation of the stomach, as in sea-sickness.

It does not derange digestion, and is therefore of value in checking the cough of phthisis and bronchitis, especially when accompanied by vomiting.

In combination with bismuth it is useful in checking diarrhea.

Administration.—Cerium oxalate is usually administered in pill form, 1-3 grains (0.06-20 Gm.) three times daily, but the powder is used when the drug is associated with other remedies.

VEGETABLE ASTRINGENTS.

Acidum Tannicum—Acidi Tannici—Tannic Acid. U. S. P.

Definition.—A monobasic organic acid, $C_{12}H_8O_7$, $COOH$, obtained from nutgall.

Description and Properties.—A light yellowish, amorphous powder, usually cohering in the form of glistening scales or spongy masses, odorless or with a faint characteristic odor and a strongly astringent taste; gradually turning darker when exposed to air and light. Soluble in about 0.34 part of water and in 0.23 part of alcohol, very soluble in boiling water and in boiling alcohol; also soluble in about 1 part of glycerin with the assistance of a moderate heat; freely soluble in diluted alcohol and sparingly in absolute alcohol, almost insoluble in absolute ether, chloroform, benzol, or benzol.

Dose.—1–20 grains (0.06–1.2 Gm.) [7½ grains (0.5 Gm.), U. S. P.].

Official Preparations.

Collodium Stypticum—Collodii Styptici—Styptic Collodion.—Used externally and locally. (Tannic acid, 20; alcohol, 5; ether, 25; collodion, to 100.)

Glyceritum Acidi Tannici—Glycerii Acidi Tannici—Glycerite of Tannic Acid.—Used externally and locally. (Tannic acid, 20; glycerin, 30.)

Trochisci Acidi Tannici—Trochiscos (acc.) Acidi Tannici—Troches of Tannic Acid.—Dose, 1–3 troches.

Unguentum Acidi Tannici—Unguēti Acidi Tannici—Ointment of Tannic Acid.—Used externally and locally (Tannic acid, 20; glycerin, 20; ointment, 60.)

Antagonists and Incompatibles.—The vegetable astringents are incompatible with the salts of iron (ferric and ferrous), and also with the salts of lead, silver, antimony, and copper; with the alkaloids, the glucosides, and gelatin; and with the alkalies and mineral acids and emulsions. Spirit of nitrous ether is incompatible with gallic acid.

Synergists.—Tonics and bitters, and also agents increasing waste, favor the action of vegetable astringents.

Physiological Action.—*Externally.*—Tannic acid has little, if any, effect upon the unbroken skin. It is feebly antiseptic. Upon raw surfaces, however, it acts as a powerful astringent, contracting the tissues and coagulating the albumin. Urucana and erythema sometimes follow its use. In weak solutions it tans dead skin. Locally applied to glandular structures, such as sweat glands, tannic acid causes a diminution in their secretions.

Internally.—**Digestive System.**—By coagulating the albumins tannic acid imparts a dryness to the mouth, accompanied by a sensation of puckering. It partially paralyzes the sensory nerve-

endings, thus blunting the sense of taste. Large doses produce vomiting by an irritant action, while diarrhea, followed by constipation, may be present.

By its action on the stomach, pepsin and peptones are precipitated, unless the stomach contents are markedly acid, albumin is coagulated, and the secretion of gastric juice diminished, all of which actions tend to impair the digestive function. The tannates formed are all susceptible of digestion, however, and tannic acid is set free. There is a partial conversion of the tannic acid into gallic and pyrogallic acids. To facilitate absorption there must be a preliminary conversion of tannic into gallic acid, and this reaction takes place in the intestine. A diminution of peristalsis is followed by constipation.

Circulatory System—Its astringent property makes tannic acid a valuable hemostatic. It arrests hemorrhage partly by preliminary contraction of the blood-vessels, but more particularly by coagulating the proteid of the blood.

Nervous System—No special effect has been observed.

Absorption and Elimination—As tannic acid combines so readily with the proteids of the intestinal canal it is not absorbed, as a rule, in large amounts. Some of the ingested tannic acid is eliminated unchanged by the intestines. Most of it is converted into gallic acid in the intestines, and as such is eliminated by the urine and stools. The tannate that is absorbed may be found in the blood, possibly a sodium salt of tannic or gallic acids. Sodium tannate may be found in the urine. Much of the tannic acid taken up is completely oxidized.

Uterus—No special influence other than arresting hemorrhage when locally applied has been noted.

Intestinal Action—A dose of 3 grains (0.2 Gm.) may cause pain in the stomach and intestines. Following such a dose, there may be coating of the tongue, thirst, eructation of gas, and tenesmus. A tendency to hemorrhoidal congestion is enhanced.

Therapeutics.—*Externally and Locally*.—TANNIC ACID is a valuable application for *bedsores* and *ulcers*. Its astringent property is of use in cases of *enteritis*, *impetigo*, *eczema*, *scald head*, and *eczema* of the *chronic dermatizing variety*. It is beneficial in *hyperdermia* of the *hands* and *feet*, of the *stomach* and *genitals*.

The GLYCERITE OF TANNIN, applied locally in cases of *stomatitis* and *ozena* as sequelae of scarlet fever or measles, is of some benefit. The same preparation or a powder may be used in *stomatitis*, *tenositis*, and *pharyngitis*, as well as in cases of *canary* or *mercurial gonorrhea*. The tannates are beneficial in *gonorrhea* such as *STAPHYLOCOCCI* OF TANNIC ACID are employed for *hemorrhoids*, *psoriasis*, *prolapse*, and *rectal ulcers*.

An AQUEOUS SOLUTION OF TANNIC ACID is very useful in *leucorrhoea*. The glycerite and iodoform tannin are excellent agents in *inflammation of the cervix uteri*. TANNIC ACID also dispels the odor and allays the discharges in *cervicovaginal uteri*, being applied as a

vaginal douche. It is useful as a *causcripta*. Injection of the acid into the urethra is of some value if much benefit may be derived from it. It is added to a 4 per cent solution of tannic acid and controls hemorrhage.

Internally.—TANNIC ACID is valuable in treatment of *diarrhea* as an antidote for poisoning by astringents. These tannates are more or less astringent and may be given as a purgative.

Administration.—For hemorrhages are given. For effect upon the intestines in pills, 3-5 grains, or it may be given as a solution, or as an ointment. Styptic collodion for incised wounds.

Organic Combinations

Because of its irritating properties it has been largely supplanted by a number of its derivatives, *tannalbin*, *tannigen*, *tannoform*, *tannon*.

Tannalbin.—This is a compound of tannic acid and albumin, obtained as a red-brown powder, and is used in the treatment of intestinal disorders. It is not absorbed in the intestinal canal and not by the gastric juice. It is used in the treatment of intestinal disorders. The dose of tannalbin is from 4 to 15 grains in proportion.

Tannigen.—This is a yellowish gray powder, odorless and tasteless, hygroscopic, insoluble in alcohol. It acts best in the alkaline state (Rost), by the gastric secretions. It is used in the treatment of diarrhea in about the same dosage as tannalbin.

Tannoform.—This is a product of the condensation of gallotannic acids. It is a pale yellow powder, soluble in alkaline solutions. It is valuable in the treatment of hemorrhages, burns, hyperidrosis, pruritus, and hemorrhoids (0.25-0.5 Gm.). A number of tannoform preparations, such as *rubus*, *juglans*, *rhodany*, *cat*, etc.

Tannon, also called *tannogen*, is a light brown powder, insoluble in water and alcohol. It has been recommended in diarrhea in 15 grains.

Tannocol.—This combination of tannic acid and albumin.

Acidum Gallicum—Gallic U.

Definition.—An organic acid, $C_6H_2O_6$, gallic acid.

Description and Properties.—Needles or triclinic prisms; odorless, has a permanent in the air. Soluble in 87 parts of water at 25° C.

Dose.—5-20 grains (0.3-1.2 Gm.) [

Physiological Action.—Gallic acid resembles tannic acid in its action, but does not coagulate albumin, and therefore does not possess the local influence of the latter.

Therapeutics.—*Externally and Locally*—Gallic acid is seldom used externally. Locally, tannic acid is preferable, but gallic acid is effectual applied as a glycerite, 1 dram-1 ounce (4.0-32.0 Gm.), in cases of *tonsillitis* and *pharyngitis*. Gallic acid and stramonium ointment in equal parts form an unguent for *hemorrhoids*. In alcoholic solution it is applied to the membrane of *diphtheria*.

Internally—It is doubtful if gallic acid has any distinct indications.

Administration—Gallic acid is not to be combined with iron. It is administered in powder or pill form. The glycerite and the ointment are used locally.

Related Compounds.

Pyrogallic Acid is of use in *zime*, but produces a discoloration of the skin.

Eugallol and **Lenigallol**, acetates of pyrogallic acid, have been advised as substitutes of pyrogallic acid in *psoriasis* and acute and chronic eczemas.

Pyrogallol, 2 grains (0.12 Gm.), is used in *internal hemorrhage*. As an astringent, 2 dram-1 ounce (4.0-32.0 Gm.), it is palliative to *psoriasis*, and it is also beneficial to *lepra* and *sp. trachoma*.

Gallanol, the anhydride of gallic acid, is a bactericide, and is useful in *psoriasis* in the form of a powder in an ointment (1 to 30). It is also used in a solution of 10 per cent strength. It relieves the pruritus of *Acromioclavicular*, *Brachial* and *axillary* *phlegmon* a mixture is used consisting of gallanol 10 parts, ammoniac 1 part, and alcohol 50 parts.

Gallicine, methyl ether of gallic acid, applied in fine divided form with a brush, is a benefit in *dermatitis* and *mycosis*, as well as in *eczema of the eyelids*.

Galla—Gallæ—Nutmeg. F. S. P.

Origin—An excrescence on *Quercus infectoria* (Kirtz), caused by the punctures and deposit of eggs of *insecta*, *gallæ*, *gallæ*.

Quercus infectoria is a small tree, of the size of a shrub, 4 to 6 feet (1.2-1.8 M.) high, indigenous to the south of the Mediterranean.

Description and Properties—Nutmegs are subglobular about 1 inch (25 Mm.) in diameter, more or less interrupted with shallow smooth, heavy, hard lines with a minutely serrate base the middle circumference with the central cavity containing either the empty level of insect or pulverulent remains of it, irregular, but strongly astringent.

¹ Same in substance is sold in green externally.

Official Preparations

Tinctura Gallæ **Tinctura Gallæ** **Tincture of Nutmeg**—*Dose*, 1-2 fluidrams (40-80 Gm.) 4 times a day.

Unguentum Gallæ **Unguentum Gallæ**—Ointment of Nutmeg—Used externally.

Physiological Action.—Its action is that of tannic acid, which is derived from galls.

Therapeutics—*Externally and Locally*—GALLA in combination with stramonium liniment or 1 dram (4.0 Gm.) of powdered opium to each ounce (32.0 Gm.) of nutmeg ointment, is an excellent application for *external hemorrhoids*. For *eczema of the scalp*,

herpes, fissured nipples, indolent ulcers. The ointment has proved beneficial, as well in *hemorrhoids* and *rectal prolapse*. One part of the ointment of vaseline is a most excellent application for the contraction following extension of the rectum locally, but is recommended as a general application to the relaxed mucous membranes of the rectum.

Administration.—Galls are used in infusion or ointment. The tincture

Quercus—Quercus—

Origin.—The dried bark of *Quercus* ten to twenty-five years of age, and deprived of the leaves, growing chiefly in the temperate zone, oak is a stately tree, 60 to 80 feet high. It is native to Wisconsin and Eastern Texas.

Description and Properties.—The bark is a layer, about $\frac{1}{8}$ inch ($\frac{1}{4}$ Mm.), pale brown; the inner surface is rough and of a coarse, fibrous fracture. It has astringent taste. As found in the shops, it is yellowish, which does not tinge the saliva yellow.

Dose.—Belton given in substance, but the chief use of the drug is for external

Official Preparation

Fluidextractum Quercus.—**Fluidextractum Quercus** (U. S. P.).—Prepared from the official bark of the white oak. The medicinal properties are contained in the bark.

Dose.—Average dose: 15 minims (1 c.

Physiological Action.—The bark is astringent.

Therapeutics.—*Externally* as an ointment in *hemorrhoids*, *prolapse of the rectum*, *corrhoea*. The drug is also served as *tooth-powder*. It stains the linen. Its use. Pessaries made of the bark are used in *uterine hemorrhage*. For *scrofula* it is injected into the tissues for the purpose of producing and consequent contraction of the tissues. It is of service in diarrhea and dysentery.

Administration.—Externally in the form of the powdered bark almost exclusively as an injection. The laity were formerly wont to grate them and mix the galls with oil, believing them to be a cure for dyspepsia and scrofula.

Gambir—Gambiris—Gambir. U. S. P.

Definition.—An extract prepared from the leaves and twigs of *Quercus Gambir* (Hunter) *zosterum*. Both drugs contain a large percentage of tannic acid and its compounds. Gambir was introduced on account of the difficulty of securing in the market true *Acacia catechu*. The *Tinctura Catechu Composita* and the *Tinctura Catechu* (U. S. P., 1890) are replaced by *Tinctura gambiris composita* and *Tinctura gambiris*.

Description and Properties.—Irregular masses or cubes about 25 mm. in diameter, externally reddish-brown, pale brownish gray or light brown, fracture dull earthy, friable, crystalline, inodorous, bitterish, very astringent, with a sweetish after-taste.

Dose.—Average dose 15 grains (1 Gm.), U. S. P.

This takes the place on October 1 of the Pharmacopoeia of 1890. Catechu is an extract prepared from the wood of *Acacia catechu*, natural order of Leguminosae.

Official Preparations.

Tinctura Gambiris Composita—Tinctura Gambiris Composita—Compound Tincture of Gambir.—*Dose*, 4-8 fluidrams (2-4 Gm.), U. S. P. (Average 50 grains contains 25 Gm. maceration and percolation, with distilled water, U. S. P.)

Trochisci Gambiris—Trochiscos (ac.) Gambiris—Troches of Gambir.—*Dose*, 1-6 troches. Each troche contains 1 grain (.06 Gm.) of gambir.

Physiological Action.—Gambir and catechu do not differ in their action from tannic acid. Both gambir and catechu depend on tannic acid for their activity. They show no variations in therapeutic activities. Being less soluble, their action on the intestines is more prolonged.

Kino—Kino—Kino. U. S. P.

Origin.—The inspissated juice of *Pterocarpus Marmoratus* K. Schum., a tree (called *Jaya* in Bengal) 10 to 30 feet (3-9 Mm.) high, indigenous in India and Japan.

Description and Properties.—Small, angular, dark brownish red, on the surface, very astringent and sweetish, when the color deepens. Soluble in alcohol, nearly insoluble in ether and only slightly in cold water.

Dose.—10-20 grains (.6-2 Gm.) [$\frac{1}{4}$ grains (.05 Gm.), U. S. P.]

Official Preparation.

Tinctura Kino—Tinctura Kino—Tincture of Kino.—*Dose*, 4-8 fluidrams (10-30 Gm.) [1 fluidram (4 Gm.), U. S. P.]

Physiological Action.—Its action is similar to that of tannic acid. It colors the saliva, stools, and diapers red.

Therapeutics.—*Externally and Locally.*—Kino is an efficient dressing for *flabby, indolent ulcers*, acting as a stimulant. Yet the other astringents deserve precedence. As a gargle in *pharyngitis* and *relieved mouth* kino is valuable, but, owing to its disagreeable taste, kramenia is to be preferred. Owing to its speedy action it checks the hemorrhage in *epistaxis* where other astringents fail. In *leukorrhoea* and *gonorrhoea* an infusion or injection is serviceable.

Internally.—In *disentery* and *chronic diarrhoea* with profuse serous discharges. It is less irritating than the other astringents.

Administration.—The powder is used as an insufflation in epistaxis, and is dusted on ulcers. In diarrhoea it is best to use kino in combination with opium or chalk mixture. The tincture is used internally.

Kramēria—Kramēriæ

Origin.—The dried root of *Krameria* L., and of *Krameria argentea* Martine L. to Bolivia and Peru, growing in sandy localities to 8000 feet (900-2440 M.).

Description and Properties.—The root is knotty, and several headed above, rounded in the thinner pieces, scaly, deep rust-brown, astringent, inodorous; wood pale, brownish-tasteless. The root of *Krameria lutea* (Hay) has a dark purplish-brown bark about 1/2

Dose.—8-30 grains (0.5-2.0 Gm.) [15]

Official Pre

Extractum Kramēriæ—**Extracti Kramēriæ** 5-10 grains (0.3-0.6 Gm.) [7 1/2 grains (0.5

Fluidextractum Kramēriæ—**Fluidextracti Kramēriæ**—**Dose**, 5-30 minims (0.3-2.0 Cc.) [

Syrupus Kramēriæ—**Syrupi Kramēriæ** 1-2 drams (2.0-4.0 Cc.) [1 dram (4 Cc.), 1

Tinctura Kramēriæ—**Tincturæ Kramēriæ** 1/2-2 drams (2.0-8.0 Cc.) [1 dram (4 Cc.)]

Trochisci Kramēriæ—**Trochiscos Kramēriæ**—**Dose**, 1-5 troches. (Each troche contains

Physiological Action.—The action is similar to that of tannic acid.

Therapeutics.—**Externally** an ointment of application is of little consequence as an ointment for *hemorrhoids*, or the application of the diluted tincture or fluid extract, especially in *anal fissure*, for which it is especially beneficial where the gums are inflamed, since it checks the accumulation of blood, and by drying its walls, rendering defecation less painful, and preventing the formation of ulcers. The powder is also used in *prolapsus ani* and *hemorrhoids*. It is used extensively in the preparation of *gums*, especially beneficial where the gums are inflamed. A mouth-wash and gargle, and *pharyngitis*, and *relaxation of the throat* gained a wide reputation for a *uterine hemorrhage*. It is a good *hemostatic* and is also used in *chronic diarrhea* and *hemorrhage*.

Administration.—The powder may be given either by insufflation or by means of a syringe, or by injection and enema the fluid extract. The rectum must be emptied of the extract, 1 dram (4 Cc.) of water, is emptied into the bowel and the process several times. This is continued until the patient is comfortable, but as the fissure gradually heals the patient little, if any, pain. Keep the patient laxative. The success attending the treatment of hemorrhoids is the best in *ozena*, followed by an ins

Hæmatöxylon—Hæmatöxyli—Hæmatoxylon.

U. S. P.

(CAMPENCH.)

Origin.—The heart wood of *Hæmatococcus campechensis* L., a tree 30 to 40 feet (9-12 M.) high, indigenous on the shores of the Gulf of Campechy and in certain parts of South America.

Description and Properties. Heavy, hard, externally purplish black, internally brownish red, marked with concentric circles of lighter gray, very solid, faint, agreeable, taste sweetish astringent. When chewed, stains the mouth dark pink.

Only the preparations of hæmatoxylon are used externally.

Official Preparation.

Extractum Hæmatöxyli. **Extracti Hæmatöxyli—Extract of Hæmatoxylon.**—*Dose*, 5-15 grains (0.3-1.0 gm.) (15 grains (1.0 gm.), U. S. P.)

Physiological Action.—Its astringent properties are due to the tannin which hæmatoxylon contains.

Therapeutics.—*Externally and Locally.*—It is a valuable antiseptic, as well as a healing application in *gangrene* and *hemorrhoidal sores*. It is also beneficial as an injection in *hemorrhoids*. Hæmatoxylon has a very agreeable, sweetish taste, hence it is well taken by children. It is of marked benefit in *infantile diarrhea*, but has the disadvantage of coloring the discharges and diaper blood-red or purplish blue, causing much alarm to the mother. The urine is also colored. It is used in *dysentery*, *tuberculous diarrhea*, and *atonic dyspepsia*. Some authorities claim that hæmatoxylon causes phlebitis.

Administration.—In diarrhea a decoction with a little aromatic sulphuric acid is the best preparation. To it may be added a little syrup of ginger and camphorated tincture of opium. The decoction is, in fact, the best preparation to use.

Hamamölidis Fölia—Hamamölidis Foliörum—

Hamamelis Leaves. U. S. P.

(WITCH HAZEL.)

Origin.—The dried leaves of *Hamamelis Virginiana* L., a shrub 6 to 20 feet (1.8-6 M.) high, growing in damp woods and thickets in Canada and the United States.

Description and Properties.—Short petiolate, about 4 inches (10 cm.) long, lanceolate-oval, slightly heart-shaped and oblique at the base, acuminate at the apex, nearly smooth, membranous, taste astringent and bitter.

Official Preparations.

Aqua Hamamölidis. **Aqua Hamamölidis.** **Hamamelis Water.**—The final product hereinafter described, when used for medicinal purposes, should be prepared by the following process:—The aqua contains not 15 per cent. of the alcohol.

Dose.—Average *dose*, 2.0 ounces (56.7 cc.), U. S. P.

Fluidextractum Hamamölidis Foliörum. **Fluidextractum Hamamölidis Foliörum.**—*Dose*, 30 minims (1.5 cc.), U. S. P.

Hamamelidis Cōrtex—H Hamamelis B

Both the bark and twig, and the leaves, are mentioned by the Pharmacopœia; the former are the old hamamelis (U. S. P., 1890), becomes ham-

Dose.—Average dose: 30 grains (2 Gr).

Physiological Action.—The action of hamamelis, save that the latter exerts an influence upon the circulation.

Circulatory System.—Hamamelis acts upon the veins, the *modus operandi*, however, is not determined. Large doses produce a sense of fulness of the blood-vessels.

Therapeutics.—*Externally* and *internally*, hamamelis is a favorite application. Locally, regard it merely as a placebo. Locally, the addition of one-third its volume to a solution of *uricaria*, *rhus-poisoning*, and *phlegma*, the marked sedative properties, HAMAMELIS is official in *varicose ulcers*, *eczema*, *hemorrhoids*, as well as in checking excessive *scarcity*, *hyperidrosis*, *lupus erythematosus*.

The local action of the drug is exerted by the EXTRACT, diluted with alcohol or water, applied to the nasal mucous membrane after *rhinitis* as a spray. As a SUPPOSITORY, a piece of cotton or wool soaked with the extract, affords a most grateful relief in *bleeding*, *hemorrhoids*, etc. In *cystitis* and *hemorrhage* from the bladder, the diluted FLUIDEXTRACT or DISTILLATE, besides being a most reliable topic, affords relief from *hemorrhage* from wounds, *epistaxis*, and *hemorrhage*. The OINTMENT is used in *rectal fistula*. The OINTMENT has been employed to some extent in *hemorrhage*; it relieves the pain and stiffness in *hemorrhage*. The DECOCTION, with a little boric acid or creasote, has been recommended as a *hemorrhage*.

Administration.—The best preparation for external use, is the distilled extract. The ointment and lotion are used externally. The preparations of hamamelis are unreliable unless they be of good quality.

Geranium—Gerānii—

(CRANES)

Origin.—The dried rhizome of *Geranium* is obtained from the stem 2 to 3 feet (30–60 Cm.) high, very common in the wild as far as Kansas.

Description and Properties.—G

(1-2 Cm.) long and about $\frac{1}{4}$ inch (1 Cm.) thick, rather sharply tuberculated, longitudinally wrinkled, dark brown, bark thin, wood wedges very weak, small, forming a circle near the cambium line, medullary rays broad, central 15th large, rays thin, fragile, fusiform, taste strongly astringent.

Dose—30-40 grains (1.2-2.4 Gm.) {15 grains (1 Gm.), U. S. P.}

Official Preparation.

Fluidextractum Geranii—Fluidextracti Geranii—Fluidextract of Geranium.

—Dose, 20-40 minims (1.2-2.4 Cc.) {15 minims (1 Cc.), U. S. P.}

Physiological Action.—The action of geranium corresponds with that of tannic acid.

Therapeutics.—*Externally and Locally*—Geranium is not used externally. Its local action is varied. It is serviceable as an astringent gargle in *sore throat*, as a mouth-wash in *aphthous stomatitis*, in *relaxed conditions* of the rectum, vagina, and throat, in *buccal ulcer*, *metrorrhagia* and *anal fissure*; in *prolapsed ani* and *epistaxis*. It has also proved valuable as an injection in *leucorrhœa*, *gonorrhœa*, and *gleet*. Owing to its mucilaginous taste, it is useful in *infantile diarrhea* and for persons having weak stomachs.

Administration.—Locally, the powdered root and fluidextracts are used, but the fluidextract diluted with water is preferable. For an injection a decoction, 1 ounce (32 Gm.) to 1-2 pints (1512-1024 Gm.) of water, is used, and the decoction in milk is of service in infantile diarrhea.

Rhus Glabra—Rhôis Glâbræ—Rhus Glabra.

U. S. P.

(SUMACH.)

Origin.—The dried fruit of *Rhus glabra* L., a shrub or woody vine plant about 25 feet (7.5 M.) high, growing in many of the Southern States in North America.

Description and Properties.—*Substance*, about $\frac{1}{4}$ inch (13 Mm.) in diameter, deep-red or crimson, leaves hairy, containing a roundish stone, much potash, mucilage, tannic acid.

Dose—The preparations only are used internally.

Official Preparation.

Fluidextractum Rhôis Glâbræ—Fluidextracti Rhôis Glâbræ—Fluidextract of Rhus Glabra. —Dose, 4-8 minims (0.2-0.4 Cc.) {15 minims (1 Cc.), U. S. P.}

Physiological Action.—The action of rhus glabra resembles that of tannic acid.

Therapeutics.—*Externally and Locally*—An infusion of the fluidextract is used as a topical application for *ulcers* and *inflamed wounds*. The infusion is an excellent mouth-wash in *spongy gums*, *pyralism*, *pharyngitis*, *aphthous stomatitis* and *tonthitis*. It can be used alone, but is much more efficient when combined with potassium chlorate and glycerin, adding a little menthol 2-3 grains (0.12-0.20 Gm.), to make the mixture more agreeable. It is also of service as an injection in *leucorrhœa*.

Administration.—The fluidextract is used exclusively

Rōsa Gāllica—Rōsæ Gallicæ

Origin—The dried petals of *Rosa gallica*.

Description and Properties—Consists of numerous imbricated, roundish, retuse, deep red petals, having a roseate odor and a bitterish, slightly

Official Preparations

Confectio Rōsæ—Confectionis Rōsæ—Confection of rose petals, except in pill masses.

Fluidextrāctum Rōsæ—Fluidextract of rose petals, chiefly as a vehicle.

Physiological Action.—It acts as a mild stimulant.

Therapeutics.—*Externally* and for chapped lips and hands, and a erythema.

The FLUIDEXTRACT is used as a vehicle for buccal, aurial, and anal ulcers, and has been employed in conjunction with the pitting of small-pox. Its chief use is as a flavoring extract.

Administration.—The fluidextract of which is given internally. The decoction is applicable as a poultice.

Rūbus—Rūbi—Blavæ

Origin—The dried root-bark of the *Rubus fruticosus* Linnæus, or of *Rubus cuneifolius* Pers. plants.

Description and Properties.—The bark is blackish or blackish-gray, inner surface pale-brown, tasteless wood adhering, inodorous, taste bitter.

Official Preparations

Fluidextrāctum Rūbi—Fluidextract of blackberry root-bark, $\frac{1}{2}$ –2 fluidrams (2.0–8.0 c.c.) [15 minims (1.5 c.c.)].

Physiological Action.—Identical with that of the bark.

Therapeutics.—*Internally*.—The fluidextract is used for summer diarrhea of children—purgative. An infusion of the leaves is claimed as a remedy for debility of the bladder.

Administration.—The fluidextract is used as medicinal agents. The syrup is used as a vehicle. Blackberry cordial and infusion are other modes of administration. It is claimed that the various blackberry and raspberry preparations as remedies in diarrhea; on the other hand, because of the seeds present in the

TOPICAL REMEDIES.

RUBEFACIENTS, VESICANTS, AND ESCHAROTICS.—These consist of a series of remedies that act directly upon the skin or mucous membrane, and are known by different names, according to the amount of irritation produced. Rubefacients, as the mildest, cause a redness of the skin with dilated blood-vessels, if their action is continued, local extravasation of serum beneath the epidermis may take place, forming a blister. If their action is more severe or if long continued, death of tissue may take place, thus causing a cauterizant action with the formation of an eschar. Emollients and demulcents have an opposite effect, in that they tend to allay or prevent irritative reactions on the part of the skin (emollients) or mucous membranes (demulcents).

RUBEFACIENTS.

These are drugs which, when locally applied, are intended to produce temporary redness and congestion of the skin. Some of them are vesicant if applied in full strength, and, if their contact with the skin be sufficiently prolonged, pustulation, or even total destruction of tissue, may result.

The following list embraces the principal rubefacient drugs:

Ammonia,	Menthol,
Alcohol,	Mezereum,
Arnica,	Mustard,
Camphor,	Oil of camput,
Capsicum,	Oil of turpentine,
Chloroform,	Pitch,
Ether,	Volatile oils.
Iodine,	

Hot water and friction are also rubefacient agents.

Rubefacients are used for their influence upon the skin itself or for their effect on deep seated structures.

Rubefacients are efficient means of relieving *neuralegic pains*, conditions of *nervous debility*, *nervous excitement*, the *stasis of lacton*, and as aids in *nerve poisoning*, also to hasten the *absorption of inflammatory exudates* to remove the swelling and restore the function of *chronically inflamed joints*, etc.

Rubefacients should ordinarily be applied with friction, as rubbing of the skin aids the action of many of them.

Save one, all the rubefacients mentioned in the preceding list have been considered elsewhere in the present work.

Mezerēum—Mezerēh

Definition.—The dried bark of *Daphne* species of *Daphne*.

Description and Properties.—Into disks, the outer surface yellowish or minute blackish dots, underneath of a light. Bast in transverse layers, very tough, in constituent is an acid resin, *mezerin*; has been described.

Dose.—1-5 grains (0.06-0.3 Gm.)

Official

Fluidextractum Mezerēi—Fluidum
resin.—*Dose*, 1-5 minima (0.06-0.3 Gm.).
Decoctum Sarsaparillæ Compositum, Extrac-
ta Linimentum Sinapis Compositum.

Antagonists and Incompatibles.—by tannic and free acids, and the

Synergists.—All the vegetable of colchicum.

Physiological Action.—Its action is quite similar to that of sanguinaria. On the skin it is more of a vesicant than locally it is more of a diuretic than causing severe urinary irritation and a violent gastro-intestinal irritation would be the same as that produced by

Therapeutics.—It is a counter-irritant. Internally it is now seldom in combination with other vegetable substances in *rheumatism* and in *chronic syphilis*.

Contraindications.—Acute inflammation of the lungs, and kidneys.

Administration.—As it is new special instructions for its administration. The extract freely diluted with water for preparation to use.

Xanthoxylum—Xanthoxy

(PRICKLY ASH)

Origin.—The dried bark of *Xanthoxylum* *Clava-Herculis* (L.) Small. Both species are shrubby and attaining a height of 10 or 15 feet. *X. Clava-Herculis* is a small tree sometimes 30 or 40 feet (9-12 m.).

Description and Properties.—Prickly Ash occurs in curved or quilled outer surface brownish gray, with whitish furrowed, with some brown, glossy, straight about 1/4 inch (6 Mm.) long; inner surface

green in the outer, and yellowish in the inner layer, inodorous, taste bitterish, very pungent. *Asclepias latifolia* (Southern Privet) Asclepias, resembles the preceding, but is about $\frac{1}{2}$ inch (2 Mm.) thick, and is marked by many central corky punctures, sometimes $\frac{1}{4}$ inch (2 Cm.) high, and by stout, brown spines rising from a corky base.

Xanthoxylum should not be confounded with the bark of *Quercus venosa* L., which is nearly smooth externally, and beset with slender prickles in transverse rows.

Prickly ash contains an acid green oil, a colorless, crystalline resin, a latter principle, sugar, ash, and tannic acid.

Dose — 10–30 grains (0.6–2.0 Gm.) [30 grains (2 Gm.), U. S. P.].

Official Preparation.

Fluidextractum Xanthoxyli—**Fluidextractum Xanthoxyli**—**Fluidextract of Xanthoxylum**.—*Dose*, 10–30 minims (0.6–2.0 c.) [30 minims (2 c.), U. S. P.]

Physiological Action.—The action of xanthoxylum is quite similar to that of mezereum, though it is more of a stomachic tonic, sialagogue, diuretic, and diaphoretic, and not so much of a local irritant. It increases the heart's action and raises arterial tension.

Therapeutics.—It is used locally as a masticatory for the same purpose as mezereum, and the decoction has been highly recommended as a gargle in *chronic pharyngitis*. Internally it has no useful applications.

VESICANTS AND EPISPASTICS.

These are drugs which excite more or less local irritation when applied to the skin, the inflammatory condition is accompanied by an effusion of serum between the epidermis and dermis—*i. e.*, a *blister*.

The principal vesicants are:

Acetic acid (glacial),	Mezereum.
Ammonia (the confined vapor),	Mustard (volatile oil),
Cantharides,	Rhus Toxicodendron.
Iodine,	

There are certain drugs which affect certain parts of the skin—for instance, the orifices of the sudoriferous glands—in a special manner, and their action on these parts is such as to give rise to *pustules* rather than blisters. Drugs which affect the skin in this manner are called **PUSULANTS**. The following-named drugs are the most important of them.

Croton oil,	Silver nitrate,
Tartar emetic,	Ipecac.

Therapeutics.—VESICANTS are employed as local stimulants in *chronic ulcers* and to facilitate the absorption of effusions, as in *chronic synovitis* or *chronic thickening about the joints*.

Blisters are also of use in *endocarditis*, *neuritis*, *radiculitis*, *chronic pericarditis*, *pleuritis*, *hysterical paralysis*, and *apoplexy*, *cerebral* or *spinal meningitis*, etc.

PUSTULES are more particularly though moderate irritation are but rarely used for the same effect, preferable when it is desirable to get rid of without exciting too much inflammation.

Contraindications.—Vesicants are contraindicated in all cases of acute inflammations and in inflammation of the skin as rubeola and scarlatina. Vesicants are also contraindicated in debility, scorbutus, and in old age. They should not be used on the face, mammary glands, nor over bony prominences as processes are apt to be retarded.

Cantharis—Cantharidis

(SPANISH)

Origin.—*Cantharis vesicatoria* De C. is found in Central Europe, and found eastward as far as the Caspian Sea, and dried at a temperature not exceeding 40° C.

Description and Properties.—A small, broad, flattened cylindrical, with filiform wings, with long wing cases and ample, membranous covering of a shining, coppery green color. The peritremes are shining particles. Odor strong and disagreeable.

Cantharides contains a fatty crystallizable principle, benzol, which is the active principle, a volatile oil, and a green oil closely allied to chlorophyll.

Used externally.

Dose.— $\frac{1}{2}$ grain (0.03 Gm.), U. S. P.

Official Preparations

Ceratum Cantharidis.—Cerati Cantharidis, 320; yellow wax, 180, resin, 180, U. S. P. Used externally.

Collodium Cantharidatum.—Collodii Cantharidis, 100; benzol, 100, U. S. P.

Tinctura Cantharidis.—Tinctura Cantharidis, 100; benzol, 100, U. S. P.

The cantharides cerate is an ingredient in the

Physiological Action.—Externally applied, it is a slow though very powerful irritant to the skin or mucous membrane, producing with marked redness of the cuticle, and in a few hours after the application of caustic vesicles which soon coalesce and discharge a clear serum.

The drug not only causes irritation of the skin which it is applied, but reflexly of the deep-seated organs underneath.

The active principle of cantharides irritates the skin, producing its constitutive changes.

Internally.—*Digestive System*

produce a sensation of heat in the stomach, and may even occasion gastrodynia. Large amounts occasion severe gastro-intestinal irritation. There is a sense of constriction in the esophagus, a burning heat in the throat, pyalism, intense gastric pain, nausea, and vomiting of glairy mucus often containing blood. There is great tenderness over the abdomen, fibrinous and sometimes bloody stools, attended by gripping pain and tenesmus.

Circulatory System.—Full medicinal doses excite the heart, increasing the force and rapidity of its action, and elevate arterial tension. Under large doses the pulse and arterial pressure fall, and there is great depression of the entire circulatory system.

Nervous System.—Small doses have no influence on the nervous system other than would be produced by stimulation of the circulation. Excessive amounts have produced marked cerebral effects, consisting of partial or general convulsions, coma, and insensibility.

Respiratory System.—No effect follows medicinal doses; toxic amounts accelerate and weaken the respiration.

Absorption and Elimination.—The active principle of cantharides is rapidly absorbed, as it is eliminated, produces marked irritation of the genito-urinary organs. There is at first increase of urine, which is soon greatly diminished in amount, and which may be albuminous or bloody. There is strangury and frequent desire to micturate, and severe pain in the loins and bladder. The local irritation is apt to occasion priapism, with frequently erotic excitement and seminal emissions. There may also be swelling and inflammation of the external genitals. In women cantharides may also occasion increased sexual desire, cause abortion, or induce menstruation. Yet amatory desire does not always follow the ingestion of cantharides, even in large doses. Indeed, the aphrodisiac effect of the drug is usually more manifest under small or tan medicinal doses than from the ingestion of immoderate amounts. The drug is principally eliminated by the kidneys.

Temperature.—The temperature is at first elevated by excessive amounts, but declines together with the depression of the circulatory system.

Uterus.—The uterus and female genital organs are stimulated by the drug, as has been previously described.

Untoward Action.—The untoward manifestations do not differ from the symptoms produced by excessive amounts as described under the different systems. These various untoward effects vary in intensity according to the individuality of the patient.

Poisoning.—Toxic amounts of cantharides produce violent gastro-intestinal and genito-urinary inflammation. The general symptoms are great pain in the throat, stomach and bowels, excessive thirst, vomiting of bloody mucus, frequent stools which may contain blood, burning pain in the kidneys, strangury, scanty, albuminous, and bloody urine, painful erections of the penis, seminal emissions, swelling and inflammation of the external genitals, a rapid, small, and

weak pulse, accelerated respiration, the face, pain in the head, delirium, convulsions, and coma. The pupils are dilated, the skin is livid, the veins are engorged, and are in a condition of active nephritis.

Treatment of Poisoning.—The use of demulcents, stimulants, and opium should be avoided, as they interfere with the absorption of cantharidin.

Therapeutics.—Externally the drug is frequently of service as a counter-irritant to allay the tendency to congestion. The drug is of service in the early stage of *pneumonia* and in *pleurisy*, and is beneficial in *hydrothorax* and *hæmoptoe*.

The cure of *boils* and *carbuncles* is effected by the application of a cantharidal blister to the indurated part.

The drug is also of service in *eczema*, *scabies*, and *psoriasis*, etc.

A blister over the region of the heart affords relief in *pericarditis*.

A CANTHARIDAL PLASTER applied to the sacral nerve frequently affords great relief in some forms of *sciatica*.

In subacute or chronic inflammation of the *spinal cord*, such as *meningitis*, *myelitis*, or along the course of the *vertebræ*, will often favorably influence the disease.

Blisters are frequently of service in *osteomyelitis* of the larger bones. A blister applied to the epigastrium sometimes allay *gastric pain* and *obstinate constipation*.

Blistering over the region of the *occiput* relieves the symptoms of *chronic meningitis*. Blistering over the mastoid region will frequently relieve the symptoms of *otitis media*.

Small patches of *ticca tonsura* may be removed by blistering.

Liniments and lotions containing the drug are among the best means of curing *eczema*.

Internally.—Certain diseases of the *urinary system*, such as *debility of the bladder* with *acrid urine*, *chronic pyelitis*, *chronic catarrh of the bladder*, may be cured by small doses of TINCTURE OF CANTHARIDES.

Gleet, *prostatorrhœa*, and *spurious gonorrhœa* are cured by the drug. *Menorrhagia* and *amenorrhœa* may be benefited by cantharides.

Tincture of cantharides, with *aconite*, *digitalis*, and *phosphoric acid*, is of service in the result of old age, sexual excess, and *neurasthenia*.

In *scaly skin diseases* cantharides often proves very serviceable after arsenic and the external application of tarry preparations have failed.

Administration.—A cantharidal blister should not be allowed to remain on the skin for more than twelve or twenty-four hours, six to eight hours usually being sufficient. Care should be taken of the blisters, as they are apt to be infected very readily.

The obstinate ulcers which sometimes follow the use of cantharides blisters may be treated effectively by Toulard's cerate.

For internal use the tincture of cantharides is the only preparation to employ.

Sinapis Alba—Sinapis Albæ—White Mustard.

U. S. P.

Origin.—The seed of *Sinapis alba* L.

Dose.—120 grains (8 Gm.), U. S. P.

Sinapis Nigra—Sinapis Nigræ—Black Mustard.

U. S. P.

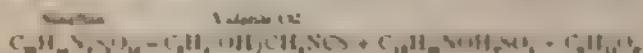
Origin.—The seed of *Sinapis nigra* L. (Koch).

Both the white and black mustard are annual plants, indigenous to Southern Europe and Western Asia, cultivated, and sometimes found wild in the United States.

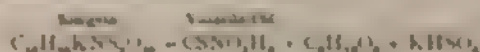
Description and Properties.—WHITE MUSTARD SEEDS are a small globular, about $\frac{1}{16}$ inch (2 Mm.) in diameter, with a crease or furrow, transverse to the flattened, hard, cream-colored, with a lateral radicle and two cotyledons, one above the other, free from starchy inclusion, taste pungent and acrid.

BLACK MUSTARD SEEDS resemble the preceding in shape, but have a diameter only of $\frac{1}{16}$ inch (2 Mm.), brownish-green or deep reddish-brown, with a testa covered with shagreen, and when crushed and macerated with water acquiring a strong and pungent odor.

WHITE MUSTARD SEEDS contain an almost tasteless, yellowish, fixed oil, and a glycoside known as *sinigrin*, which is the most characteristic substance, converting it into acrid *allyl isothiocyanate*, the volatile oil of mustard, by the action of the ferment *myrosin* and water.



Black mustard seeds contain the same fixed oil as the white mustard and a glycoside, *sinigrin*, which by the action of *myrosin* and oxygen in contact with water converts it into acrid *allyl isothiocyanate* (a volatile oil).



To the volatile oil of mustard, which is official, are due both the pungent taste and odor of the mustard powder.

Dose.—1-4 drams; 2.0-15.0 Gm. (120 grains (8.0 Gm.), U. S. P.)

Official Preparation (of Black Mustard Seed)

Charta Sinapis—Chartæ Sinapis—Mustard Paper

Öleum Sinapis Volatile—Ölei Sinapis Volatilis—Volatile Oil of Mustard. U. S. P.

Origin.—A volatile oil obtained from black mustard by macerating with water and subsequent distillation, yielding not less than 92 per cent. of a volatile residue.

Description and Properties.

strongly refractive liquid, having a very soluble in alcohol, ether, or carbon disulphide.

Physiological Action.—*Ext*

irritant, counterirritant, rubefacient. Irritation, from slight redness of skin to severe burning pain, may be produced by mustard. It is used in the treatment of rheumatism, tharides, and when applied to the face immediately a sensation of warmth is produced, followed by severe burning pain. This irritation is succeeded by paralysis and more or less of the surface may be allowed to remain in this condition, after which there is a decided diminution of

The local application of music and respiration.

Internally.—Mustard in small doses irritate the stomach and cause vomiting without depression, owing to its stimulating effect on the heart and respiration.

The volatile oil of mustard is usually. It is a powerful caustic to the tongue producing an intense burn and nose.

Therapeutics.—*Externally* and locally for the same purposes as latter-named drug when a sin Mustard when applied locally is latory and respiratory systems th efficient remedy in *syncope*, *asphy*

As a stimulant in these conditions applied to the legs.

A MUSTARD BATH, in the strength of one ounce to the gallon (3785.43 Cc.) of water, is a *cold*, and if properly used is of use when *scarlet fever* has receded.

The *meneses* may often be re-
MUSTARD SITZ-BATH, taken at the

Internally.—Other than the drug is given only to produce emetics in indigestion and narcosis.

Obstinate *hiccough* has some-
 OF MUSTARD.

Administration.—A mustard by mixing equal parts of wheat consistence of a thick paste, w cloth and applied to the skin. posed between the plaster and from adhering.

A mustard cataplasm is a weaker preparation. A flaxseed or cornmeal poultice is made, to which a small quantity of ground mustard is added. This is intended to maintain a gentler but more prolonged action than the *sinapism*.

"Mustard leaves," or plasters which may be obtained ready prepared at drug stores, are intended to be simply dipped in water and applied to the skin. Their activity may be lessened by interposing a thin piece of linen or cotton cloth between the plaster and the skin.

Liniments containing oil of mustard are efficient rubefacients, care being taken to adapt the strength of the preparation to the delicacy of the skin.

When mustard is taken as an emetic it is given in the form of an infusion, in the proportion of 1, 2, or 3 drams (4.0, 8.0, or 12.0 Gm.) to 1 pint (473.17 Cc.) of water.

A preparation known as *mustard whey* is sometimes given. It is prepared by boiling 1½ ounces (42.65 Gm.) of bruised mustard seed in a mixture of 1 pint (473.17 Cc.) of milk and 1 quart (946.35 Cc.) of water, until it is curdled, when the whey should be strained off.

Altered Products.

Thioisomamine, a product from the volatile oil of mustard, is a useful drug for dental and ear tissue. It is used in 10-20 per cent. strength as an injection or local application.

Öleum Terebinthinæ—Ölei Terebinthinæ—Oil of Turpentine. U. S. P.

Origin. A volatile oil secreted distilled from turpentine—a concrete viscous substance obtained from *Pinus* species. Minor and other resins may be present.

Description and Properties. A thin, colorless liquid of a characteristic odor and taste, both of which become stronger and less agreeable with age and exposure to air. It is soluble in three times its volume of alcohol. Oil of turpentine should be kept in well-stoppered bottles, protected from light.

Dose. 5-15 minims (0.3-1.0 Cc.), in emulsion.

Official Preparations

Emulsio Ölei Terebinthinæ—Emolui Ölei Terebinthinæ—Emulsion of Oil of Turpentine. *U. S. Disp.* A 15 per cent. by volume emulsion of the oil of turpentine containing 1 per cent. by volume of saccharine of glucose. *Average dose.* 1 fluidrachm (4 Cc.), U. S. P. One fluidrachm contains about 4 minims of oil of turpentine.

Linimentum Terebinthinæ—Linimentum Terebinthinæ—Turpentine Liniment. *U. S. Disp.* with rose-geranium. *U. S. Disp.*

Öleum Terebinthinæ Rectificatum—Ölei Terebinthinæ Rectificati—Rectified Oil of Turpentine. *Dose.* 5-15 minims (0.3-1.0 Cc.) (15 minims (1 Cc.), U. S. P.)

Physiological Action.—*Externally and Locally.*—When applied to the epidermis the drug dilates the cutaneous blood-vessels, causing a sensation of heat and producing redness of the skin and, if the oil be applied with friction for any length of time, vesication ensues, with, occasionally, intractable ulcerations. The times

of oil of turpentine when inhaled and the respiratory passages.

The drug is readily absorbed.

Internally.—Digestive System.—Turpentine produces a burning, augmented salivary secretion. The drug occasions a sensation of increased peristaltic action and is largely affected, the intestinal peristalsis the drug acting as an efficient carminative.

Large doses of turpentine produce vomiting of the stomach and bowels, accompanying, the feces often containing blood.

The drug is an efficient anesthetic of the heart.
Circulatory System.—Turpentine increases the force and rapidity of the heart's action by direct cardiac influence. Small doses of the drug, which may accelerate the heart's action. Very large doses slow the heart's action by depressing the heart's motor center.

Nervous System.—Small doses of turpentine increase reflex excitability. Large doses produce exhilaration, and incoherence or occasional coma.

There is incoordination of gait, great muscular weakness, preceding the impairment of volition.

Respiratory System.—The efficiency of the respiratory passages has been increased by the drug. The drug increases and disinfects the respiratory passages. The increase and large doses diminish the efficiency of the respiratory passages.

Absorption and Elimination.—Turpentine is absorbed in the blood, in moderate doses increasing the flow of urine, to which it imparts a turpentine odor. Large doses irritate the kidney, rendering it highly colored, and causing hematuria, and even total priapism and a frequent desire to urinate.

Turpentine is rapidly eliminated by the kidneys, but by the skin, and the mucous membranes as well.

Temperature.—The drug is a febrile.

Untoward Action.—Erythema is produced by both the ingestion and the inhalation of turpentine. In susceptible individuals it causes disturbances of the genito-urinary system, as strangury, painful erections, and priapism.

The administration of repeat

produce peculiar nervous manifestations, such as headache, drowsiness, dizziness, and a sense of mental vacuity.

Poisoning—Few cases are recorded of death resulting from the ingestion of excessive amounts of turpentine, owing to the fact that the greater amount of the drug is eliminated by the intestines.

The symptoms produced by very large doses are—great muscular weakness, abolition of reflexes, and violent vomiting and purging, with bloody evacuations from the bowels. There is great irritation of the genito-urinary tract, with constant efforts to micturate, hematuria or entire suppression of urine, painful priapism, and violent stranguary.

The skin is moist and the face flushed or cyanosed, while dilatation of the pupils, slow, labored and stertorous breathing, and occasionally paroxysms of convulsive coughing, may be attendant symptoms. Convulsions may occur. Icterus has been noted.

Either great mental excitement or profound insensibility may be present. The heart and circulatory system are greatly depressed, death, when occurring, being usually the result of cardiac failure. 15 Gm. has been deadly for a child, and 120 Gm. has been taken by an adult without a fatal result.

A form of chronic poisoning frequently is seen among those who work with turpentine, such as painters, etc., sleepiness, heaviness, easily tired, and great muscular heaviness are frequent symptoms. Insomnia, irritable heart action, acne, and general malaise are other common symptoms.

Treatment of Acute Poisoning—The stomach should be at once evacuated, and elimination favored by every possible means. The free administration of demulcent drinks is advisable, while to relieve pain, opium may be given. Other symptoms should be treated according to their indications.

Therapeutics.—Externally and Locally—OIL OF TURPENTINE is an efficient counterirritant, being employed as such in *lumbago, myalgia, neuralgia, rheumatic pains, bronchitis, psoriasis*, and various forms of *chronic inflammation*. A TURPENTINE STUFF is perhaps the most effective method in the local application of the drug. It is applied as follows: (1) A flannel is wrung out of hot water, sprinkled well with the oil, and allowed to remain in contact with the affected part for from five to twenty minutes, as indicated by the sensibility of the skin. Care must be taken in the preparation of the flannel lest the patient be chilled or scalded. (2) A vessel containing the oil is placed in hot water and a flannel wrung from the oil applied as desired.

A TURPENTINE STUFF is perhaps the most grateful and efficient local application in *psoriasis*.

Owing to its antiseptic and hemostatic properties the oil or turpentine is frequently and beneficially employed as a dressing for *lacerated wounds*.

The drug is an active parasiticide, and has been used success-

fully in the treatment of *sinus* favorably recommended, when remedy for *alopecia areata* and

TURPENTINE serves a useful and throat.

J. Solis Cohen recommends efficient means of allaying the acute laryngeal catarrh.

The inhalation of the oil hyperemia and excessive bronchitis

Internally.—TURPENTINE is intestinal flatulence, particularly atonic state of the muscles of the

The drug is frequently employed the relief of tympanitis, but also

In chronic intestinal catarrh, of any mucous membrane, turpentine

TURPENTINE is a very powerful. When given for this purpose it large dose, from 4–8 fluidrams (1 dose of some purgative like castor oil) in the form of an emulsion of the turpentine from the

As has been suggested, the influence upon relaxed and chronic membranes, rendering this remedy valuable in the treatment of chronic bronchitis, emphysema, etc. This action upon the mucous retic properties of the drug, a valuable remedy in the treatment of chronic cystitis, spermatorrhea, etc.

Contraindications.—Oil of turpentine is contraindicated in patients suffering from Bright's disease, etc. of the gastro-intestinal or genito-urinary system.

Administration.—Small doses may be given in lumps of cut sugar, but usually in the form of a capsule containing a small quantity of mucilage of acacia, if proper. 2.0 Cc. of oil of turpentine in 10.0 Cc. of water. Flavoring substances can be added, rendering the preparation not unpleasant.

In giving turpentine its tendency to irritate the mucous membranes, particularly of the genito-urinary system, care being invariably exercised.

For external use the drug may be mixed with some bland oil or ointment.

Turpentine is sometimes employed in the treatment of it should, of course, be mixed with some bland oil or ointment of acacia in the form of an emulsion.

Rhus Toxicodendron - Rhôis Toxicodendri—Rhus Toxicodendri. (*Non-official.*)

(POISON IVY.)

Origin. The fresh leaves of *Rhus toxicaria* L., a climbing shrub indigenous in Canada and the greater part of the United States westward to the Rocky Mountains.

Description and Properties.—Long petiole; alternate, the lateral leaflets sessile or nearly so, about 4 inches (10 cm.) long, obliquely ovate, pointed, the terminal leaflets stalked, ovate or oval, pointed, with a wedge-shaped or rounded base, the leaflets entire and glabrous or variously notched, coarsely toothed or lobed, more or less downy, when dry, papery and brittle; underside taste somewhat astringent and acrid. The fresh leaves abound in an acrid juice which darkens on exposure to air, and when applied to the skin produces inflammation and swelling. The leaves should therefore not be touched with the bare hands.

The fresh leaves contain a volatile principle termed toxicodendrol by Hall. In addition to this active constituent the leaves contain tannin.

Dose.—1-5 grains (0.06-0.3 gm.)

Physiological Action.—*Externally and Locally.*—The fresh leaves of this common plant are extremely irritant to the skin, generally acting as a marked vesicant and establishing severe local inflammation, manifested by acute dermatitis, excessive edema, and hyperemia. In many cases these effects are much less pronounced, while in certain individuals they are never occasioned by contact with or even chewing the leaves. As with poison sumach—*Rhus venenata*—the toxic influence of the plant derived from local application is apparently more virulent during the period of flowering.

The inflammation somewhat resembles erysipelas, being rapidly diffused and accompanied by a general systemic disturbance, including abdominal pains, nausea and vomiting with perhaps diarrhea, dysuria, and serous passages. Profuse diaphoresis and lumbar and articular pains may also result. These symptoms cease after about ten days or a fortnight without other sequel than desquamation of the affected surface.

Internally.—The effects of the drug administered internally are to cause gastro-intestinal inflammation, with drowsiness and stupor, and occasionally delirium and convulsions. Vertigo, nausea, chilliness, thirst, weak and irregular cardiac movements, diaphoresis, muscular debility, and dysuria are also reported.

Treatment of Poisoning.—Many remedies have been used with varying efficacy, to allay the toxic effect of the drug. Dermal poisoning has been relieved by glycerite of carbolic acid or alkaline lotions. In the earlier stage of external irritation warm soapsuds and sodium bicarbonate have been successfully applied. Alum-curd, ammonia in a weak solution, solution of chlorinated soda, and many other agents have been employed to meet the requirements of certain stages of the affection. Orthoform or anæsthesin in an ointment base, as oxide of zinc, is a useful analgesic.

Therapeutics.—*Externally and Locally.*—The diluted tincture—8 minims (0.5 Cc.) to 4 ounces (118 Cc.) of water—has met with some favor in the treatment of sprains, burns, etc.

In weak solution with alcohol the remedy has been used as a

stimulating application in case stings, etc.

Internally.—It has been rec it is highly doubtful if it is val

The drug is in need of muc being widely diverse opinions r is, however, sufficient testimony ities to justify further examinat remedy.

Contraindications.—The s specting its true action in disea any special contraindication to

Administration.—The tunc and should be cautiously admin

CAUSTICS OF

Caustics are medicines whic are applied. They excite infla the surrounding area. The e separated from the living tissue tion produced.

The action of caustics is typ one. The layer of cells that with the caustic employed, and smear-like, or fluid eschar, w processes, is sooner or later divided roughly into caustic ac salts, and some few organic ca fied. In many of the acids and the caustic causes oxidation an the acids an acid albumin or syr alkali albuminate; and by the duced. Many of these metal a case a characteristic hard and s

The character of the eschar involved; thus, by alkaline cau solved; fatty substances are cot Many caustics have the power systemic poisoning. The salts are of importance in this conn

Many of the caustics cause c ally being abandoned for the m

Caustics are employed for th
1. In specific acute poison
poisonous insects, reptiles, or
applied to the wound directly

Potassium permanganate, of potash, alkalis, or the direct cautery are the most reliable.

2. To destroy new growths of microbial origin. In lupus, sarcoma, carcinoma, chancre, chancroid, etc., nitric acid, alkalis, glacial acetic acid, etc. are most employed.

3. To remove small tumors, warts, polyp (nasal or genital), hypertrophied mucous membranes. Here nitric and chromic acids, silver nitrate, etc., are of service.

4. For depilatory purposes—removing hair, etc.

5. To reduce and destroy inoperable tumors. Here the more caustic alkalis, arsenic, zinc, etc., have been widely employed in the past.

6. To reduce flabby and exuberant granulations in wounds. Nitrate of silver is one of the best drugs.

7. At times to influence deeper parts, in neuralgias and inflammatory action in an internal organ, it is benched to employ a superficial escharotic.

Those escharotics which have not been discussed elsewhere will here be considered in detail.

Chromil Trioxidum—Chromil Trioxidi—Chromic Trioxide. U. S. P.

(CHROMIC ANHYDRIDE. CHROMIC ACID. U. S. P.)

Origin.—Dissolve potassium bichromate in sulphuric acid and water; decant; heat with more acid in each and crystallize.

Description and Properties.—Small needle-shaped crystals or rhombic prisms, of a dark greenish-red color and lustrous surface; colorless destruction of animal and vegetable tissues. Impervious to moist air. Very soluble in water, forming an orange-red solution. When brought in contact with alcohol, ether, glycerine, and other organic solvents decomposition takes place, sometimes with dangerous violence. Chromic trioxide should be kept in glass stoppered bottles and great caution should be observed in avoiding bringing it in contact with organic substances, such as cork, paper, acid, sugar, alcohol, etc., as dangerous accidents are liable to result. Used externally.

Physiological Action and Therapeutics.—Chromium trioxide is a powerful caustic, deodorant, and disinfectant. It coagulates albumin and oxidizes organic matter. Its action is slow, and the pain following its application is usually of shorter duration than that of most caustics. Weak solutions are stimulant, astringent, and alterative.

Chromic acid is used in the form of a paste or in solutions of various strengths for the removal of *syphilitic* warts, vegetations, *condylomata*, etc. As a caustic and stimulant application in many diseases of ear, nose, and throat it serves a valuable purpose, as in nasal polyps, enlarged tonsils, chronic and syphilitic laryngitis, laryngeal papillomata, chronic interstitial glaucoma, tuberculous of the tongue, *osoma*, ulcerations of the mouth, etc.

A 10 per cent solution of chromic acid has been found serviceable in the treatment of *hyperidrosis*.

A solution of 1 part of chromic acid in 10 parts of water is an efficient lotion for disinfecting gonorrhea, leucorrhea, etc.

Sessile piles and salivary fistulae.—The parts with pure chromic acid.

Potassii Hydröxidum— Potassium Hydroxide

(POTASSIUM HYDROXIDE; CAUSTIC POTASH.)

Origin.—Prepared by evaporating to dryness a solution of potassium carbonate in water.

Description and Properties.—Masses, hard and brittle, showing a greenish-yellow color and an odor of lye, and of a very acid and caustic taste. When in contact with organic tissues it should be tested and found to be caustic. Exposed to the air, it rapidly absorbs carbon dioxide and forms potassium carbonate. It is soluble in 0.4 part of water and in 2 parts of alcohol. It should be kept in well-stoppered bottles made of hard glass. Used externally.

Södi Hydröxidum— Sodium Hydroxide

(CAUSTIC SODA.)

Origin.—Prepared from a solution of sodium carbonate in water.

Description and Properties.—Masses, showing a crystalline fracture, of a white color and a strong alkaline odor. Great caution is necessary in testing it. Exposed to the air, it rapidly absorbs carbon dioxide and forms sodium carbonate. It is soluble in 0.4 part of water and in 2 parts of alcohol. Soda should be kept in well-stoppered bottles made of hard glass. Used externally.

Physiological Action and Therapeutics.—Sodium hydroxide is one of the strongest antiseptics. It possesses the property of neutralizing free acids, decomposing them, and forming solutions of fibrin, a process which is essential to the healing of wounds.

When applied to the soft tissues, it produces a moist, ashen, and granulating ulcer behind the eschar.

When potassium hydroxide is used in doses it produces all the symptoms of soda, freely diluted, have the same effect.

As a caustic, potassa is used in the same manner as soda.

The action and therapeutic uses of soda are similar to those of potassa, save that it is more caustic to the heart, muscular and nervous system. In the treatment of ulcers of the potassa, the latter preparation is used.

To limit the caustic action of soda, a plaster should be applied first, and

Upon the skin exposed in the hole in the plaster the caustic is placed, the skin having been previously moistened. The caustic action may be arrested at any time by wetting the part with vinegar.

Acidum Aceticum Glaciāle—Acidī Acēticī Glaciālīs —Glacial Acetic Acid. U. S. P.

Origin—Prepared by distilling dry sodium acetate with strong sulphuric acid.

Description and Properties—A clear, colorless liquid, of a strong, vine-gar like odor, and a very pungent, purely acid taste. Its specific gravity at 25° C. (77° F.) should not be higher than 1.049, corresponding to at least 99 per cent. of absolute acid.

Used externally.

Physiological Action and Therapeutics—Glacial acetic acid is a powerful corrosive poison, having an action similar to that of the mineral acids. The drug is principally used as a caustic for the removal of warts and corns, and occasionally for blistering the skin.

Acidum Trichloraceticum—Acidī Trichloracēticī— Trichloroacetic Acid. U. S. P.

Definition—A monobasic organic acid, CCl_3COOH , usually obtained by the oxidation of acitrated chloral with nitric acid.

Description and Properties—White, deliquescent, rhombic crystals, having a slight, characteristic, mildly pungent odor. Very soluble in water and alcohol; in the latter, part of the acid is changed into the ester. The aqueous solution on heating is decomposed with the formation of chloroform and carbon dioxide. $\text{CCl}_3\text{COOH} = \text{CHCl}_3 + \text{CO}_2$.

10 parts of trichloroacetic acid and 1 part of water form a liquid known as *acribum trichloroaceticum laqueatum*; it is often dispensed in this form. (See *Forma Laqueatum*.)

It precipitates proteids and is used as a reagent for the detection of albumen in urine and milk.

Trichloroacetic acid is far stronger than acetic acid and should be used with great caution.

Calx—Calcis—Lime. F. N. P.

Origin—Obtained by burning white marble, oyster shells, or the purest varieties of natural calcium carbonate.

Description and Properties—Hard white or grayish-white masses which, in contact with air, gradually attract moisture and become deliquescent and fall to a white powdery mass, of a sharp, caustic taste. Soluble in about 700 parts of water, insoluble in alcohol.

Used externally.

Physiological Action and Therapeutics—Quicklime when used undiluted is caustic, producing effects similar to those described under *Potassa*.

For caustic purposes it is usually mixed with potassa (potassium calx). When lime is given in diluted solution it acts as an astringent and antacid. (See *Lime Calx*.)

The conditions for which lime is employed as a caustic are mentioned under *Potassa*.

Zinci Chlōridum—Zinc U.

Origin.—Prepared by dissolving zinc in nitric acid, then zinc oxide, and finally evaporate.

Description and Properties.—Masses, irregular or moulded into practicalities as to make tasting dangerous, unless has an astringent, astringent taste. Very water, forming a clear solution, very soluble in small, glass-stoppered bottles.

Used externally.

Official 1

Liquor Zinci Chlōridi—Liquōria Z
(U. S. P.)—Used externally.

Physiological Action and
caustic, antiseptic, disinfectant, hemostatic, according to the strength of action is painful, yet, while limited to the seat of application.

Poisoning by zinc chloride produced by a violent corrosive

The drug formerly enjoyed cancer, especially *epithelioma*, in of "caustic arrows" inserted to separate it from the healthy tissue.

It is used as a paste and lotions, putrid ulcers, *navi*, and syphilis.

SOLUTIONS OF ZINC CHLORIDE
for the destruction of glands, and for the destruction of glands.

A weak solution of zinc chloride for gonorrhea, leucorrhea, and hemorrhoids.

For caustic purposes the zinc is a paste prepared with starch, glycerine, or powdered althea. Mide 8 parts, zinc oxide 1 part, dilute 1 part. The cuticle must always be kept moist with a paste, strong water of ammonia.

Brōmum—Brōmi-

Origin.—It is found both in seawater and from the mother-liquor of salt works in the

Description and Properties.—Evolving, even at ordinary temperatures, a gas, and having a peculiar smell. Soluble in 28 parts of water and readily absorbed. Be kept in glass-stoppered bottles, in a cool place.

Used externally.

Physiological Action and Therapeutics — BROMINE is a powerful corrosive irritant, the fumes of which occasion severe irritation of the eyes and respiratory passages, with cough, hoarseness, and dyspnea. When taken into the stomach it produces all the symptoms of corrosive poisoning.

The drug is an active caustic, deodorant, and disinfectant. It was formerly extensively employed, particularly during the Civil War of the United States, for the treatment of *hospital gangrene*, for which it is a most efficient remedy. Bromine has also been used as an injection (1 part to 3 of alcohol) in various forms of *cancer*. Owing to the pain attending the operation, however, the treatment has not been generally adopted.

Bromine is an efficient disinfectant, and has been employed to disinfect and deodorize the atmosphere of hospitals, etc. Berlin sanitary officials declare that "3½ ounces of bromine can disinfect a space of 918 cubic feet, and deodorize a space of 7000 cubic feet."

EMOLLIENTS, DEMULCENTS, AND PROTECTIVE AGENTS.

EMOLLIENTS are substances which soften, relax, and protect the tissues to which they are applied. They relieve pain and tension by diminishing heat and lessening the pressure on the nerves.

Emollients and demulcents are largely interchangeable terms. The former are applied to the skin, the latter, to mucous membranes.

The principal emollients are:

Glycerin,
Soap liniment,
Starch,

Fats and oils,

Hot fomentations,

Poultices,

Lard,
Olive oil,
Almond oil,
Spermaceti,
Linseed oil,
Cacao butter,
Petroleum,
Paraffin,
Petrolatum,
Vaseline, etc.

Linseed meal,
Oatmeal,
Bran,
Bread,
Flour,
Eggs, etc.

DEMULCENTS are substances which soothe and protect the parts

to which they are applied. The nature, and are employed for the while emollients are principally

The important demulcents are

Acacia,	Marsh
Barley,	Lacrie
Cetraria,	Starch,
Almond,	Tragac
Flaxseed,	Glyceri
Slippery elm,	White

Both emollients and demulcents to relieve irritation of the skin softening the skin and mucous lining or chapping from exposure agents to prevent *bedsores* and imating surfaces, as between the children.

Demulcents are employed if there is an *irritated or inflamed* whether of the respiratory, gastric as in *bronchitis, gastritis, enteritis, cystitis, etc.*

Demulcents—such as *FLAXSEED* or *SASSAFRAS-PITH*—are very agreeable to *thirst* and to relieve the *irritated affections*.

PROTECTIVES are agents used to *injured or diseased surfaces* from *air, water, etc.*

Certain agents are classed as *protectives* by their *absorptive power of taking up blood or fluid present*.

They are useful agents as *protectives* in *excoriated, abraded, or burned surfaces*.

The principal protectives are

Collodion,
Solution of gutta-percha,
Solution of sodium silicate,
Court-plaster (emulsion),
Lycopodium,
Charcoal,
Animal charcoal,
Purified cotton.

The emollients, demulcents, and protectives are sufficiently important to merit a chapter given them elsewhere in the present

Glycerinum—Glycerini—Glycerin. U. S. P.

Origin—A liquid obtained by the decomposition of vegetable or animal fats or fixed oils, and containing not less than 95 per cent. of absolute glycerin.

Description and Properties—A clear, colorless liquid, of a thick, syrupy consistence, only to the touch, odorless, very sweet and slightly warm to the taste. When exposed to the air it slowly abstracts moisture. Specific gravity not less than 1.260. Soluble in all proportions in water or alcohol, also miscible in a mixture of 3 parts of alcohol and 1 part of ether, but insoluble in ether, chloroform, carbon disulphide, benzene, benzol, and fix 1 or volatile oils.

Dose.—5 to 60 minims (0.3-4.0 Cc.; 1 fluidram (4 Cc.). U. S. P.)

Official Preparations.

Glyceritum Amyli—Glyceriti Amyli—Glycerite of Starch.—Starch, 10, water, 10, $\frac{1}{2}$ ounce, No.

Used internally or externally.

Suppositoria Glycerini—Suppositoria (per) Glycerini—Suppositories of Glycerin.—Each suppository contains $\frac{1}{2}$ grm in 100 lbs. of glycerin.

Used as required.

Gelatinum Glycerinatum—Gelatini Glycerinati—Glycerinated Gelatin.—A mixture of equal parts of gelatin and glycerin. The mass when cold is hard, but easily melts on applying gentle heat.

Used for suppositories and bougies.

Of late years both ointments and cerates have been largely superseded, especially in Europe, by oleated gelin pastes and glycerogelins. The former are mixtures of the medicinal agents with starch, dextrin, or kaolin, and glycerin, with water, petrolatum, or lard, and are intended chiefly for anæsthetic, anæsthetic, or permanent effects. The glycerogelins are firmer than the pastes, and must be melted before they can be applied (Hunt).

Glycerin is also contained in the following official preparations:

Glyceritum Phenolis, Glyceritum Acidi Tannici, Glyceritum Boroglycerini, Glyceritum Hydrastis, Mucilago Tragacanthæ, Massa Hydrastis, Pulvis Phosphori, and in many extracts and flavescentes.

Antagonists and Incompatibles.—Glycerin is incompatible with potassium permanganate and with chromic acid.

Synergists.—Its emollient properties may be enhanced by other emollients and demulcents.

Physiological Action—Externally and Locally.—When glycerin is applied to the skin or mucous membrane it is ordinarily bland and unirritating, although in certain cases the drug occasions a sensation of burning and smarting, which may be due either to an impure preparation, the rapid absorption of water from the tissues, or merely to a marked idiosyncrasy on the part of the patient. Should the pure drug show a tendency to irritate the skin, the glycerin should be properly diluted with water.

Preparations more concentrated than the specific gravity recommended by the U. S. Pharmacopœia—viz. 1.240—should be avoided, because of their irritating properties.

Glycerin abstracts water from the tissues, and is rapidly absorbed through the skin. It possesses marked diffusive power, being capable of diffusing itself freely over and through organic matter.

Internally.—The principal action of glycerin when taken inter-

nally is that of a purgative. The rectum, either as an enema or in t

Glycerin is readily absorbed & is thought to undergo oxidation, creasing body-weight. Some co it is not in the least degree nutriti

When immoderate amounts o detected in the urine, while unde produced similar to those resulting

Following the ingestion of v extreme muscular weakness, dryn colored urine, collapse, and deat poisonous, excessive amounts b symptoms above described.

Therapeutics.—*Externally* and efficient remedy for *chapped h*

Fissured nipples and *fissure o* pure GLYCERIN or with glycerin i makes an efficient application to h

GLYCERIN is employed as an i used alone or medicated with bi of opium.

GLYCERIN is one of the best so tampons wet with glycerin or wit very serviceable in *leucorrhœa* and *metritis* with *congestion* and *subin*

GLYCERIN possesses marked ant applied pure or combined with oil of most affections of the skin.

LOTIONS OF DILUTED AQUEOUS quently employed in various dise such as *fissure of the tongue*, *chroni coryza*, *pharyngitis*, etc.

A mixture of GLYCERIN AND W ness of the mouth from fever or oth

GLYCERIN is an efficient topic edema of the prepuce, and is a ser wounds, carbuncles, boils, etc.

GLYCERITE OF STARCH is an e acute eczema, and quite an efficient variola.

Internally.—The principal inter relief of *habitual constipation*, being than in occasional, constipation, ar females than to males, and to tho retained in the rectum than in th For the purpose of relieving const mouth, alone or associated with c (4.0–8.0 Cc.) injected into the rec

most agreeable method, by the insertion into the rectum of a GLYCERIN SUPPOSITORY.

Administration.—Whether glycerin be used externally or internally, it should always be chemically pure, otherwise much irritation may be produced.

For external use it may be used pure or mixed with water, or in various lotions, ointments, etc.

Internally it is seldom given alone, but with syrups, water, wine, or other alcoholic liquors.

Ådeps Lånæ—Ådipis Lånæ—Wool-fat. U. S. P.

Definition.—The purified fat of the wool of sheep, freed from water. The hydrous wool-fat, which contains "not more than 30 per cent. of water," is still retained in the Pharmacopœia, if this be heated on the water bath, with stirring, until it ceases to lose weight, it is converted into *Ådeps Lånæ*.

In making certain ointments, the water contained in hydrous wool fat is objectionable, for such preparations *Ådeps Lånæ* is preferable.

Petrolātum Ålbū—Petrolāti Ålbī—White Petrolatum. U. S. P.

"A white, unctuous mass of about the consistency of an ointment." It is purified petrolatum and is used in the preparation of the ointment of benzoic acid, the ointment of phenol (Unguentum Acidi Carbolici, U. S. P.), etc.

Õleum Olivæ—Õlel Olivæ—Olive Oil. U. S. P.

Origin.—The fruit of *ex-pressed* from the fruit of *Olea europæa* L., a shrubby, thorny, medium-sized tree indigenous to Western Asia, but cultivated in the countries bordering on the Mediterranean and in the Southern United States, California, and several South American and other countries.

Description and Properties.—A pale yellow or light greenish yellow, oily liquid, having a slight, pleasant odor, and a rather disagreeable taste, with a faint and bitter taste. Very sparingly soluble in alcohol; but readily soluble in ether, chloroform, or carbon disulphide. Olive oil should be kept in well stoppered bottles, in a cool place.

Dose.—7 rectiss.

Physiological Action and Therapeutics.—Olive oil is a singularly bland and agreeable oil, and very useful as an emollient and demulcent. It serves as an efficient protective to the skin, from which it is readily absorbed. As a lenitive and protective in cases of superficial *wounds, bruises, excoriations, burns, bites and stings of insects, sprains*, etc., it serves a valuable purpose.

It is extensively employed by dermatologists to soften and facilitate the removal of *crusts, scales, and epithelial debris* of various cutaneous disorders.

The application of warm olive oil, made with gentle friction, to *painful and enlarged mammary glands* during pregnancy and after parturition generally lessens the pain and swelling.

The drug is an efficient palliative in *painful dysenteries* and is sometimes injected into the rectum as a soothing emollient in *dis-*

entry, and to destroy "scatur-
duced by them.

Frequently the forcible injection
dilate an unusually tight *stricture*
to the introduction of a sound.

Olive oil is habitually employed
ters, specula, pessaries, etc.

Where a fat or an oil is not
the most efficient demulcents to
from corrosive irritating drugs.

Olive oil is a useful and pleas-
siderable extent for that purpos-
facilitating the discharge of *gall-st-*
the secretion of bile, which may
in favoring the expulsion of these

Öleum Amygdalæ Expr Exprëssi—Expressed C

Origin.—A fixed oil expressed from b
var, *amara* and *dulcis*, (De Candolle), a t
nous in Western Asia and cultivated in sub

Description and Properties.—
only liquid, almost inodorous, and having
in alcohol; soluble in ether and in chloro
in well-stoppered bottles, in a cool place.

Dose.—1-4 fluidrams (4.0-8.0 Cc.) [1]

Expressed oil of almond is cor

Physiological Action and Th
of almond is a peculiarly bland a
and emollient, being used both
same purposes as olive oil.

Öleum Lini—Ölel Lini-

(OIL OF FL

Origin.—A fixed oil expressed without
mum L.

Description and Properties.—A
slight, peculiar odor, and a bland taste. Wh
and acquires a strong odor and taste, wh
and allowed to stand in a warm place, it is
ent, resin-like mass. Soluble in about 10
portions, in ether, chloroform, benzin, carbon
seed oil should be kept in well-stoppered bo

Dose.— $\frac{1}{2}$ -2 fluidounces (15.0-60.0 Cc.)

Physiological Action and The
of flaxseed oil are similar to tho
important uses, when mixed with
is in the treatment of *burns*.

The linseed itself is used exte
in the form of a tea, for *cough*, etc.,
an excellent poultice for all *deep-se*

Acácia—Acâciæ—Acacia. U. & P.

(GUM ARABIC.)

Origin—A gummy exudation from *Acacia Senegal* Willdenow, and other species of acacia, small trees, about 20 feet (6 M.) high, found in India and Africa, especially in the district of Khartoum, westward to Senegambia.

Description and Properties—In roundish tears of various sizes, or broken into angular fragments, with a glasslike, sometimes iridescent fracture, opaque from numerous fissures, but transparent and nearly colorless in thin pieces, nearly tasteless, taste insipid, mucilaginous, insoluble in alcohol, but soluble in water, forming a thick mucilaginous liquid. Acacia should be slowly but completely soluble in a parts of water.

Official Preparations.

Mucilago Acaciæ—Mucilaginæ Acaciæ—Mucilage of Acacia—34 (or 100 p.).
—*Dose, freely.*

Syrupus Acaciæ—Syrupi Acaciæ—Syrup of Acacia—*Dose, freely.*
Acacia is contained in Emulsum Amygdalæ, Pulvis Cretæ Compositus, and in some tracheæ.

Physiological Action and Therapeutics—Acacia is a valuable demulcent, and gum-water is in ordinary use to serve as a protective to inflamed and irritated mucous membranes of the respiratory, alimentary, and genito-urinary tracts, as in cases of *pharyngitis*, *laryngitis*, *dysentery*, *gastritis*, *typhoid fever*, and in *febrile affections* generally. The mucilage of acacia is sometimes used as a protective for superficial *burns*, *excoriations*, etc.

Ūlmus—Ūlmi—Elm. U. & P.

(SWEET ELM.)

Origin—The inner bark of *Ulmus rubra* M. Sp., a medium sized tree, from 30 to 60 feet (9-18 M.) high, found in the United States and Canada.

Description and Properties—In fragments varying in length and width, about $\frac{1}{8}$ inch (1 Min.) thick, length, 1-2 lines, when the inner surface is folded, fracture fibrous and woody; the transverse section is white, fibrous, and slightly pitted, taste mucilaginous, insipid.

Official Preparation.

Mucilago Ūlmi—Mucilaginæ Ūlmi—Mucilage of Elm—*Dose, freely.*

Physiological Action and Therapeutics—Elm is a decided demulcent and possesses nutritive properties. It is pleasant to the taste and does not readily disturb the stomach. It is principally used as a demulcent in diseases of the gastro-intestinal and genito-urinary tracts, as *diarrhea*, *dysentery*, *cystitis*, *urethritis*, etc. The fibrous bark is molded into tents used to dilate the neck of the *uterus*, *pusulous openings*, etc.

In the form of tracheæ (elm lozenges) ulmus is excellent in the treatment of sore throat.

Althæa—Althææ

(MARSH)

Origin.—The dried root of *Althæa* of the temperate portion of Northern and Western Asia.

Description and Properties.—From 4 to 6 inches (10-15 Cm.) long, about 1 inch thick, deprived of the brown corky layer and marked with a number of circular spots, and of a somewhat fibrous; internally whitish and fleshy. It fractures, and has a faint, aromatic odor and astringent, mucilage, sugar, and pectin.

Physiological Action and Properties.—It is emollient, demulcent, and protective, and is especially emollient in irritable and inflamed conditions of the respiratory, digestive, and urinary tracts.

Tragacantha—Tragacanthæ

Origin.—A gummy exudation from the roots of other species of *Astragalus*, low shrubs, found between Eastern Persia and Greece.

Description and Properties.—It is a thick, white, or contorted, marked by parallel lines or rings, horn like, and tough. It contains 33 per cent of gum soluble in water.

Official Form.

Mucilago Tragacanthæ—Mucilage of Tragacanth.—Dose, freely.

Physiological Action and Properties.—It is demulcent and nutritious, and may be used as acacia, Iceland moss, etc. It is particularly efficacious as a soothing agent in irritable conditions of the skin.

Sassafras Medulla—Sassafras Pith.

Origin.—The dried pith of *Sassafras*, indigenous in North America.

Description and Properties.—It is a thick, white, or coiled, light, spongy, white, medullous, and mucilaginous liquid, which is not precipitated by alcohol.

Official Form.

Mucilago Sassafras Medullæ—Mucilage of Sassafras Pith.—Dose, freely.

Physiological Action and Properties.—Sassafras pith is an agreeable demulcent.

may be used for the same purposes as slippery elm, tragacanth, acacia, etc. It forms a pleasant vehicle for more active remedies.

Chōndrus—Chōndri—Chondrus.

(Irish Moss.)

Definition—The dried plant of *Chondrus crispus*, L., Langle.
One part of chondrus boiled with 30 parts of water yields a solution which gela-
tifies on cooling.

Dose.—As a demulcent drink, 15 grains 4 times, U. S. P.

Kaolinum—Kaolini—Kaolin. U. S. P.

Definition—A native aluminum silicate, consisting largely of the pure silicate,
 $H_2Al_2Si_2O_8 + H_2O$. It is a very pure clay.

Properties—Soft, white or yellowish white powder, odorless, and having an
earthy or—like taste.

Insoluble in water.

Kaolin is contained in *Cataplasma Kaolini* (q. v.). It is used in dusting powders,
also in pastes containing easily reduced bodies such as silver nitrate or potassium per-
manganate, which cannot be mixed with ordinary excipients.

Official Preparation

Cataplasma Kaolini—Cataplasma Kaolini—Cataplasma of Kaolin
U. S. P. Introduced in response to a request for an external clay preparation,
similar to a number of European ones. The constituents are kaolin (57 per
cent), tartaric acid, methyl salicylate, glycerin, and small quantities of thymol and oil
of peppermint.

Used as a poultice in mild local infections. Usually applied hot.

Talcum—Tālci—Talc. U. S. P.

Definition—A native hydrous magnesium silicate, official under the same name
in the various Pharmacopœias.

Many of the commercial talc in powders contain talc and borax, and

Properties—Talc is very soft and greasy; when mixed with water, it forms a white
or pearly powder. It feels greasy to the touch, hence its popular name soap-
stone. It is used as a dusting powder, and in some pill masses.

Talcum Purificatum Tālci Purificāti—Purified Talc. U. S. P.

Talcum purified by treatment with hydrochloric acid. Used in the pharmacopœial
method of preparing certain ointments, waters, and emulsions.

The same preparation is to be found in the National Formulary.

Ceratum Rēsinae Compōsitum Cerāti Rēsinae Compōsita—Compound Rosin Cerate. U. S. P.

Composed of resin, yellow wax, rosin, turpentine, and lavender oil.

Emplāstrum Adhæsivum Emplāstri Adhæsivi— Adhesive Plaster. U. S. P.

This is to take the place of *Emplastrum Venereum* (U. S. P., 1890) from which it
differs chiefly in the absence of mercuric iodine.

For formula and method of preparation see the Pharmacopœia.

LIST OF MATERIA MEDICA.

Paraffinum—Paraffini—Paraffin. U. S. P.

Description.—It is used by the Germans, chiefly of the methane series. The melting point is between 51° and 57° C. (124° and 135° F.). The melting point of the British Pharmacopœia is between 54° and 56° C. (130° and 133° F.), while the "paraffinum solidum" of the German Pharmacopœia is between 74° and 80° C. (165° and 176° F.).

Gelatinum—Gelatini—Gelatin. U. S. P.

Description.—It is a substance that upon ignition it leaves not more than a per cent of residue. The residue on the market has an acid reaction.

Lycopodium—Lycopōdii—Lycopodium. U. S. P.

Description.—The leaves of *Lycopodium clavatum* L. and of other species of lycopodium are found in dry woods, distributed over the greater portion of the United States.

Composition and Properties.—A fine powder, pale yellowish, very mobile, and does not absorb water and not wetted by it, but sinking upon being thrown into a flame. Under the microscope the leaves are tetrahedral, the surfaces marked with reticulated ridges, and short projections. Lycopodium contains a fixed oil and a volatile base, methylamine.

Physiological Action and Therapeutics.—Lycopodium is an expectorant, and possesses great power of absorbing oils. Its expectorant and absorptive power render it an excellent remedy for excoriated surfaces, *eczema*, *herpes*, *intertrigo*, *scalded skin*, etc.

Its peculiar property of not being wetted with water makes it a valuable agent to prevent irritation or chafing caused by the moisture of the skin of infants.

It is used as a basis for insufflations and in pharmacy to prevent the adhesion of pills.

Unguentum—Unguēnti—Ointment. U. S. P.

Description.—It is constituted by lard, 80, constitute the base of simple ointment. The only ointment is Unguentum Aquæ Rosæ.

ANIMAL EXTRACTS (ORGANOTHERAPY).

THE striking fact that various excretions and tissues of the living organism, when administered under certain conditions, possess a peculiar therapeutic value is now well ascertained. The idea, although generally considered an innovation in therapeutics, has long been the subject of studious attention, yet only in recent years has the practical application of organotherapy claimed professional recognition, and the nature and operation of its curative properties acquired unprecedented significance. Extracts derived from almost every portion of the human system, together with many animal secretions, have been prepared, and their efficacy tested by searching experiment. It was reserved for the noted investigator, Brown-Sequard and his associates to inaugurate, as late as 1882, the system of organotherapy as known to-day and promulgate the theory resulting in the now-established medicinal potency of glandular extracts.

Among the earliest and most original essays prompted by the new procedure was Brown-Sequard's hypodermic injection of an extract from the recent testicles of mammals, in the treatment of *semle debility*. It should be noted, in passing, that, curiously enough, as there is no new thing under the sun, this special employment of organic extract for the relief of morbid conditions finds an analogue in a custom of very ancient origin, the high authority of Pliny the historian, attesting that the Grecian and Roman debauchees were wont to consume the testicles of asses to restore their dissipated energies.

While it must be admitted that the benefits derived from the administration of testicular juice have failed to realize the ardent anticipations of its earlier advocates, we may cheerfully concede that the experimental impetus imparted by it to clinical and therapeutic investigation has added considerably to our scientific knowledge in the realm of medicine and gone far to alleviate the ills of suffering humanity.

The study of the internal secretions threatens to revolutionize physiology; and we must remember the position in which this matter stood, and still stands, in relation to our knowledge of the cell and of cell action. The conclusions reached by Dr. Sæmus bid fair to change the entire basis of our conception of physiologic function, and consequently of therapeutics.

The profundity of Sæmus's work necessarily impedes its speedy acceptance, for the number of those capable of comprehending it, and even giving the requisite time to it, is small. But the least that can be said by any capable observer who has examined his theory is that Sæmus has earned the right to a hearing, and this insures the acceptance of what is assumable in due time.

**Glândulæ Thyroïdeæ S
roidârum Siccârum—D
U. S. P.**

Definition.—The cleaned, dried, and freed from fat

Description and Properties.—slight, peculiar odor; partially soluble in

Dose.—Average dose—4 grains (0.2

Numerous extracts of the thyroid are to be the active constituent. *Alcohol*, and preparations on the market.

Thyrocalcium and *thyrocalcium* represent introduced which must not be confused with exactly the opposite of that of the thyroid from the blood, *thyrocalcium* from the milk, of removed.

Numerous chemical studies have seemed to show that the action of peculiar body rich in iodine. It is a substance of the gland, and is a principle, *iodothyron* much remains to be learned concerning it as the active principle of amount in different glands and at

The most rational and successful perhaps, was that of Murray in deductions from Kocher's surgical neous injection of a *thyroid extract* many cases of which have improved, and cured by the adoption of this case have included the ingestion of a glycerin extract, and the administered as food. The test amply attests the efficacy of the universal acceptance. It has, the Pharmacopœia of 1900.

Action.—If injected into the vein, an acceleration of the heart action increases the amount of urine excreted and diarrhea. It seems probable that symptoms that were observed when were in reality due to the presence of large doses, in man, symptoms seen in exophthalmic goiter have been the effect of increasing catabolic breaking-down of proteids, in this effect, combined with its diuretic and treatment of obesity.

Therapeutics.—With the treatment of Basedow's disease, lipomatosis universal, thyroid insanity, it would seem as its limitations. The successful ad-

obtained in some of the above diseases, however, have stimulated many observers and experimenters to make a wider trial of this form of medication. Isoniaz has been helped by its use.

The dosage, method of administration, and danger-signals are no less important than the indications for its use. The hypodermic administration of the liquid extract and the grafting of the fresh gland have long fallen into disuse, and the tendency of the present day is to administer the powder or to give tablets or capsules prepared from the desiccated fresh gland. The dose varies with the individual, and for this reason it is advisable to begin with small doses, which should be gradually increased until the desired effect is produced. Beginning with 1 or 2 grains a day, as much as 15 grains may be administered, the prescriber always being on the *qui vive* for poisonous symptoms. During the course of administration special attention should be given to the respiratory and cardiac apparatus, and at the first appearance of rapid pulse, embarrassed respiration, rise of temperature, vertigo, or gastric disturbance, its use should be abandoned.

Improvement has been noted in several cases of malignant *syphilis*, Mennies considering that thyroid acts as a powerful stimulant and a useful adjuvant to mercury and potassium iodide in the treatment of this disease.

The favorable results often attending the partial employment of animal agents in diseases of corresponding organs, and especially the noteworthy benefits derived from the application of the thyroid treatment in myxedema, have suggested the preparation of many extracts of varying efficacy.

PARATHYROID GLAND—These glands when given in animals are capable of causing muscular tremor and other symptoms. It has been suggested that they may prove of value in treating pathological tremors, particularly *paralytic arum*.

THYMUS GLAND—This organ contains bodies rich in isoline similar to those found in the thyroid but as yet no therapeutic application has been followed by marked success.

PIEUTARY BODY—Inasmuch as aromegary has been found to be associated very frequently with disease of the pituitary body it has been suggested that this body might be of some service, but thus far success in its use for this disease has been negative. The gland is a complex structure anatomically, and further research may give some results.

NUCLEIN is a complex protein body, characterized by its large percentage of phosphorus. The phosphorus exists in the form of nucleic acid, so far as is known, this acid is the same in all cells, yet the basic part differs in various nucleins.

When administered hypodermically or orally, nuclein increases the number of leucocytes in about three hours. The amount of increase varies with the subject: it may be slight or it may be three-fold; it occurs principally in the polymorphous cells.

Nuclein is of some value in conditions of infection where the

symptoms are due to general involution, results are obtained in simple *anemia* in a 5 per cent. solution, dose 1 f on an empty stomach. Vaughan's effect of moderate injections has without untoward manifestations, completely to a similar treatment.

It is also stated upon high authority in "all forms of *anemia*, in *chronic disorders*, and in acute *anemia* (Aulde), the nuclein adopted being thymus glands. The latter author advocates the treatment of *typhoid*, in which *phagocytosis* is defective.

BILE.—This has already been

BONE-MARROW has proved (Frazer), and has also been employed

PANCREAS EXTRACTS.—These are used but as yet very crudely and with

Careful technic is desirable in their use and their further study may be of great value

SUPRARENAL GLANDS.—These

SERUM-T

Among the marvels of science which have distinguished our century no achievement of greater moment to the welfare of humanity has been wrought to the field of biologic, pathology, and therapeutics. The limits of the present work preclude an extensive and complicated subjugation of the theory and development of the various branches in contemporaneous research, showing to the student of modern therapeutics

A glance at the history of the lactic treatment of infectious diseases underlying all later discoveries has shown that at a much earlier period than we have reached of actual attainment it is natural to look back to the transcendent services rendered to humanity. It is known that the ancient Hindus attributed the origin of the virus of the small-pox to the tribes and caravans of farther Asia. The virus, or *horse-pox*—the mammalian virus of the lactation in the horse, camel, and

The inoculation of human virus with the virus of the small-pox is probably coeval with the importation of the virus by the Saracens. Certain it is that the Arabs and Chinese adopted the inoculation of small-pox, although the

consigned the practice as a monopoly to women. Of the developments of the treatment for small-pox we refer to special works.

It was reserved for Jenner, however, in 1776, to commence the systematic and exhaustive study of the subject destined to prove inestimably beneficial to mankind. His early experiments were but a repetition of the empirical, yet prophetic, test of the English farmer, and it was not until 1798 that Jenner published his first paper upon the subject, vaccination being transported to America in the following year. Such is the brief, yet eloquent, record of an achievement which experience has proved to be of incalculable benefit to man. To-day there is no question among the more enlightened members of the profession that the operation, *properly performed*, is an absolute safeguard against the infection of small-pox.

Strange, indeed, is it that a century of comparative quiescence should have elapsed since Jenner pointed the way to the startling accomplishment of the present epoch. Yet not until Pasteur, in 1880, announced to the world the issue of his labors touching the protective inoculation of animals was the broken thread of pathogenic research taken up anew, and the task of solving its mysteries resumed—be it said with more profound acumen and far more complete appliances than ever before.

It is a matter of record how the French savant demonstrated that cultures of the bacilli of chicken-cholera, when thoroughly dried and long exposed to the air, lost their virulence, and that fowls inoculated with the attenuated virus were rendered insensible to the attacks of more energetic micro-organisms. It was, *mutatis mutandis*, a modification or development of the Jennerian principle. "The history of vaccination constitutes the first step in a long series of labors inspired by the admirable discoveries originating in the genius of Pasteur. The principle is always the same—to diminish the strength of the virus and inject it into the animal which we wish to render immune" (Bernheim).

A striking departure from Pasteur's method by Salmon and Smith, in 1886-87, led indirectly to the latest evolution of inoculative therapy. They showed conclusively that animals may be rendered immune against certain infectious diseases by inoculating them with filtered cultures containing the toxic products of pathogenic micro-organisms entirely free from the living bacteria to which they owe their origin. By this process immunity against the bacillus of hog-cholera was attained in pigeons, the disease being almost invariably fatal to these birds. A little later (1889) Roux, employing similar sterilized cultures, succeeded in protecting susceptible animals against the anthrax bacillus, and more recently (1890) Behring and Kitasato have proved that immunity against the action of the tetanus bacillus may be conferred by the use of toxic products in solution freed from the presence of active germs—in a word, that *purely chemical agents* sufficed to attain the object hitherto deemed wholly dependent upon the influence of living bacteria. The significance of this discovery could hardly be over-estimated. By

it the entire theory of causal pl which the immunizing property modified. If not a living orga proved to be the immunizing a fluences must proceed from some olism—some organic force inher ascertain the nature and operatio determine the *rationale* of acqui earnest attention of savants th province of the text-book of problems of immunity. In this v as applied to Therapeutics can be

Tetanus.—The first proof tha of ballicary origin, was furnished reproduced the symptoms in a r from a human tetanus wound. T jacent soil, but it was not until isolating pure cultures, proving o the disease.

The earliest case treated with a Bolognese physician, Dr. Gagliard

In December, 1890, Behring the serum of animals rendered injection of iodine trichloride in tl izing tetanic poison, whether in th the property not being possesse Not only did they succeed in pre nized in the serum a curative pow and cure of mice. At the same ti that the immunity conferred by l lasting only fifteen days.

Kitasato's preventive injection- gradually decreasing doses of iodi Behring, who successfully applied and horse. Various results of ex ing, among other interesting phen the spleen renders immunization showed that the serum of animals toxic, becoming so only after a po that the spleen and the fluids of in antitoxic properties.

The present status of tetanus ar fulfilled all that was hoped for it, and within the cerebral substance l be of some service. Meltzer has re phate by intrarachidian injections, a enally successful result following it

Diphtheria.—It is in the treatr disease that serum-therapy has ach

the marvels wrought by its influence attracting more and more the attention both of the medical profession and of the laity.

The micro-organism of the malady was described by Klebs in 1883, his investigations being quickly followed by those of Loettler, who confirmed Klebs' discovery and announced that it was possible not only to isolate, but also to produce, cultures of the microbe.

Sérum Antidiphthérique—Séri Antidiphthérico—Antidiphtheritic Serum.

(DIPHTHERIA ANTITOXIN.)

Definition.—A fluid separated from the conjugated blood of a horse immunized through the inoculation of diphtheria toxin (U. S. P.). The German Pharmacopœia recognizes a similar fluid serum.

Antidiphtheric serum gradually loses its power, the loss in one year varying between 10 and 20 per cent. "The standard of strength, expressed in units of antitoxin power, should be that approved or established by the U. S. Public Health and Marine Hospital Service (U. S. P.). All manufacturers selling antitoxins and toxin in the District Columbia, or in States where that the one in which it is manufactured, must secure a license issued by the Secretary of the Treasury on recommendation of the Surgeon-General of the Public Health and Marine Hospital Service.

Dose.—Average dose, 5000 units. Immunizing dose, for well persons, 500 units (U. S. P.).

The serum has now been made official in the U. S. Pharmacopœia.

Caution.—Should the serum be kept in several glass containers in a dark place at temperatures between 45° and 75° F. (10° and 25° C.).

From a careful consideration of the subject in its relations to diphtheria, we may safely conclude:

1. That immunized serum forms a remedy which experience proves to be wholly innocuous and eminently adapted for use in human infection.

2. That antidiphtheric serum has in every respect corresponded with the most sanguine hopes of its advocates, its employment being attended with astonishing success wherever properly used and in sufficient quantities.

3. Finally, that it is incontrovertibly established that by means of injecting serum temporary immunity from infection may be readily conferred, permanent protection being contingent merely upon a renewal of treatment.

The present status of diphtheria antitoxin may be presented in a few words. It has established itself as a specific in the treatment of this disease. During the past year the use of larger doses has become more general, and it seems certain that better results are obtained. The administrators of the Chicago Department of Health give 2000 units in all cases of suspected diphtheria, and employ 1000 units as an immunizing dose. During the months of November and December this department treated 210 cases of bacteriologically proved diphtheria, all diphtheric cases, with a death-rate of 4.1 per cent. Some two and a half years ago when antitoxin was not used, the death-rate from diphtheria treated by this department was about 35 per cent.

Tuberculosis.—It may be said that the microbial nature of tuberculosis was not established upon the subject before the discovery of the organism. Villemin in 1866 brought out the infectious character of the malady in an almost revolutionary way, creating a new era in Germany, through the indefatigable efforts of Koch, who developed and elucidated the theory. He discovered the bacillus of tuberculosis, and by isolating and cultivating it, the pure culture was produced, and tuberculosis in every form was addressed to the Physiological Society in 1882, and at once stimulated the work of others who fully confirmed his discovery.

Various methods of inoculation have been proposed: 1, Inoculating the patient with attenuated tuberculosis; 2, inoculating with species, as from birds; 3, inoculating with tuberculin; 4, injection of tuberculin; 5, inoculation of immune animals against tuberculosis; 6, inoculation of animals; 7, finally, inoculation of immunized animals. With the last method the physician is properly concerned. The fifth method was proposed by Babès, Richard, and Hénecourt, and has been the subject of many cases in which various cures have been effected. The greater obstacle of the procedure lies in the isolation, the greater part of the animals dying of nephritis.

By the sixth method, as employed by Bernheim, largely obviated, a careful procedure was followed, animals proving the most efficacious. The success of immunizing consists in the use of tuberculin, secreted by Koch's bacillus. The success of Bernheim in preparing the antitoxin was due to his using upon a large number of animals the tuberculin obtained by Bernheim were effective. The results indicated improvement, and the results were convincing. So convinced was he of the value of the method that he emphatically declared it to be the only possible in tuberculosis. Within a few years he has announced important advances in the treatment of tuberculosis.

It is difficult to sum up in a few words the serum treatment of tuberculosis. The use of any true antibodies that are of a specific nature in patients suffering from tuberculosis is the only way for believing that an immunizing treatment is possible in the not-far-distant future.

Pneumonia.—Inoculations of

munity in lower animals, reduction of virulent germs be attained by the use of desiccated pneumonic viscera. The saliva of a patient, collected after defervescence, ensures protection to the mouse, the same being true of blood serum. Immunization of animals was inaugurated by Emmenich and Fovitsky in 1891, subsequent investigators confirming their experiments under varying conditions, Fox and Seabia finally employing human serum in the inoculation of rabbits with marked success.

The therapeutic interest of the subject centers in the application of inoculation to man. The early experiments of Fox and Seabia were without result, neither reaction nor amelioration attending their treatment; but in 1892, Klemperer reported favorably concerning immunization in 40 cases of human pneumonia.

In January, 1893, Lova communicated to the Academy of Medicine in Turin the application of serum-therapy with auspicious results. Rizzolo also reported successes. Up to the present time, however, it cannot be said that a successful pneumococcus serum has been devised.

Cholera.—The microbe of this terrible disease had been sought since 1848, yet the subject had never been profoundly studied until Koch succeeded in isolating the germ. Being associated with other micro-organisms, the bacillus had remained undetected, being distinguishable, in fact, only in fulminant attacks of the disease, as was noted by Strauss and Roux.

Haffkine has definitely produced results in the immunization against cholera. He has used his serum on a large scale in India, and his results are encouraging.

Sopucomia.—The streptococcus of Fehleisen (*erysipelas*), which causes erysipelas, was discovered by Nepveu in France, and Hüter, in Germany (1888-89), and has been the subject of careful study by Klemperer and others, in the hope of determining its availability as an immunizing agent. Employing the serum of immunized rabbits, it has been found possible by intravenous injection to cure the disease in mice, the serum proving efficacious only against the disease with which the animal supplying it was inoculated. Subsequent experiments have been attended with varying results, Marmorek, in February, 1895, having succeeded in obtaining a germ of streptococcus so virulent that the hypodermic injection of 1 c.c. was fatal to the rabbit in thirty hours. Inoculation with this microbe or its toxins conferred immunity upon rabbits, which furnished a preventive and curative serum.

Encouraged by previous experimentation, Charrin and Roget now sought to apply the method of serum therapy in the treatment of puerperal fever. Having satisfied themselves of the curative property of the serum of a mule inoculated with the microbe of erysipelas, collected fifteen days after the eighth inoculation, they injected subcutaneously 8 Cc. of serum in a woman affected with the fever. The report is as follows: "The next day no improvement. A second injection of 8 Cc. Next day condition slightly

improved, but still serious. The following day rapid improvement in health; and early establishment of good health.

Antistreptococcic serum gives the diphtheria antitoxin in point of most successful in erysipelas and scarlet fever are reported where duration of the disease and post-mortem and sequelæ, such as otitis media due to streptococci. Aronson's serum from which much is hoped.

The latest reports on antistreptococcic serum are as the earlier ones.

Syphilis.—The pathogenicity of the disease. The most recent work of Schick, by Flexner, Noguchi, Metschnikoff, that a spiral organism, *Spirochaeta pallida*, is the cause of the disease. Experimental in animals, and the way seems to be the therapy of syphilis.

Typhoid Fever.—The bacillus in the kidneys by Bouchard in Eberth, who studied the germ in an exceedingly toxic ptomain, but of inoculating animals.

Wright and Semple have demonstrated a toxin against typhoid which produced a serum, but results are of no therapeutic conclusions.

Reptile Poisons.—It has long been known that reptiles possess natural immunity to their own poison of the toad having been demonstrated. Immunity was at first thought to be a condition existing in the salamander.

So far as it affects man, Calmette's antivenin has been used with success in the treatment of snake-bites, to the extent of curing them.

Calmette's antivenin has now become a reliable mode of treating cobra-poisoning.

Noguchi has in course of preparation a serum against rattlesnake-poisoning, which is now perfected.

Carbuncle (Anthrax).—The bacillus, has proved a subject of much interest to the bacteriologist and the clinician. The treatment have been chosen with great care. Immunizing serum include many

protective inoculation may be regarded as useful for sheep, but for man no reliable serum is known.

Rabies.—In January, 1881, Galtier announced that intravenous inoculation of rabid saliva confers immunity upon sheep, confirming his experiments later in the year by injecting the fluid into tame sheep and one goat. Pasteur, Chamberland, Roux, and Thuillier pursued experiments in a similar line, with somewhat negative results.

By passing the virus successively from dogs to monkeys, Pasteur was able to attenuate its virulence, and finally, by transferring the poison from monkeys to rabbits, a serviceable immunizing agent was obtained, still further experiments perfecting the method in view.

Satisfied with his success, Pasteur now turned his attention to the inoculation of man against hydrophobia. The first operation (in 1885) was attended with auspicious results, and from that moment the savant's laboratory was invaded by affected individuals demanding cure. Institutes were founded in various parts of the world, that in Paris being the center of bacteriological study in France. In America the subject has received wide attention, but in many instances the benefits derived from Pasteur's inoculative procedure have been held to be of doubtful importance by intelligent observers.

Pasteur's treatment of hydrophobia is based on the fact that rabie virus may be intensified or attenuated at will. If successive inoculations be made into rabbits with fluid taken either from the dog or the monkey, the virulence may be so increased above that of a street-dog, requiring from twelve to fourteen days for incubation—that after about one hundred inoculations the period of incubation may be reduced to seven or even six days. Thus, the most powerful virus yet attained, Pasteur termed *virus fixe*. When protected from light and air this virus retains its strength for a long period. Pasteur further observed that the cords of rabbits which had been dead for some time contained a less virulent poison than those of animals freshly killed, especially when the air was dry and the cord protected from putrefactive influences, the most efficient inoculation being that of an emulsion made from cords exposed to dry air for ten and fourteen days, followed by emulsions of cords exposed for shorter periods.

With regard to the administration of serum, several precautions are of great importance. The absolute cleanliness of the syringe, for example, should be an object of especial care. To this end a glass barrel is preferable, in order that impurities may be readily detected and removed. For packing purposes rubber or asbestos should be employed, and the instrument should be so constructed as to permit cleaning and sterilizing of every part before and after use.

The mode of injection and the amount of dosage (measured in antitoxin units) vary somewhat according to the nature of the dis-

case and the age and susceptibility taken to use only the most reliable.

It has been impossible to compass the entire field covered by the literature. For a multitude of details, embelishment, and for many expressions by a consideration of so-absorbent to the extensive bibliography of therapy.

It may be readily imagined the vision of Jenner's vaccination has been knowledge and delicate application day. It is scarcely surprising, studies, after an interval of unproductive, elicit from all parts of the world in any previous epoch, together presenting testimony touching new greatly increased number of cases the limitations of serum-therapy thoughtful observers is that its purposes are deeply rooted in the methods of great Nature. Its startling phenomena awaken new biological science; yet, though the so ample and momentous a field character of modern scientific inquiry truth or falsity.

OPSONINS, OPSONIC

THE

For the last ten or fifteen years have been given in medical research itself resists disease and throws it or groups of animals show great especially those of bacterial origin to such infections? Why is it degrees of resisting power at different conditions? What are immunity factors do they depend? Over the working some of the greatest mysteries have been discovered and is rapidly being built definite limitality of certain diseases has already the underlying individual factors and these factors have been either restricted by definite methods chemical, and pathological facts.

Among the many discoveries well-founded falls the subject of

there is no more "live" subject in the current literature than that of opsonins. That there *are* such chemical bodies in the blood-serum as opsonins has been pretty definitely settled. Just what bearing these bodies have upon the question of susceptibility and immunity is by no means yet settled. At the most they are only one factor among the many. Their comparative value or importance relative to the other factors is not determined. The discovery of opsonins and their *evident* importance, the attractive lines of research work that the study of opsonins offer, and the results of a practically new therapy against bacterial disease have attracted the attention of the medical world. To-day not only the laboratories are busy establishing the status of opsonins from a physico-chemical standpoint, but practitioners in practically all specialties are collecting clinical data from the vaccine therapy, that is based, as far as we yet know, upon opsonins.

As is well known, the investigator who has named these certain chemical bodies that are in the blood-serum opsonins is Sir A. E. Wright, of London. It is due to his observations that their identity was established and the practical technique of vaccine therapy based.

The subject of opsonins falls under the larger heading of phagocytosis when we consider the main divisions of immunity. The blood has three principal methods of resisting bacterial invasion: (1) A bacterial destroying action (bactericidal), (2) an antitoxic action, and (3) a phagocytic. In other words the blood assists the body to oppose the pathogenic germs by killing some varieties, by neutralizing the poisons that other varieties secrete (such as the case of the diphtheria bacillus), and finally by destroying still other varieties by the devouring action of the white blood-cells.

Opsonins have only to do, as far as is known, with the last method, and in fact opsonins are chemical bodies in the serum that aid in the destruction of pathogenic germs by causing them to be devoured by the white blood-cells. The assistance is given in this way. The invading germ is first neutralized by these chemical bodies, opsonins, which come in contact with it, and only then can the germs be taken up by the white cells. Just what the interaction is between germ and opsonin is not known, but most investigators consider it best explained by the so-called Ehrlich's "side-chain theory." The active germ is supposed to possess numerous unsatisfied arms or radicles, by which it combines other cells, just as is the case in the simpler boxes of organic chemistry. Until these radicles are satisfied it has been found that the germ is not devoured by the phagocytic white blood-cells. The opsonins in the serum are chemical bodies that neutralize these arms, and when the germs are bathed with a serum containing opsonins, these germs become neutralized and can be and *are* then taken up and destroyed by the white blood-cells, evidently because all these attacking arms have been made powerless. To go into the theory a step further, it is thought that one method by which a pathogenic germ injures or destroys a living body-cell is first by "fastening" itself to the cell by these arms of union (the body-cell has like unsatisfied arms),

and then pouring into the cell-body its cell-destroying elements. The opsonins are supposed to come into this close chemical union with the germ. The germs are at least so neutralized or acted upon by the opsonins that they can now be taken up by the leucocyte when they could not have been taken up before they were so neutralized. In this way the opsonins aid phagocytosis, and their importance is very great if it be found that phagocytosis is the principal factor of immunity and susceptibility to bacterial insult. Many of the foremost investigators, like Metchnikoff, believe this is so. The word "opsonin" Wright coined because it means "to prepare food for" (*ὀψονίζω*). The opsonins prepare the food (germ) for the devouring cell (leucocyte).

Wright found that each variety of germ was neutralized by a definite variety of opsonins—i. e., the action of opsonins is specific.

Not only did Wright establish the identity of opsonins, but he also devised a method of estimating the amount or strength of them in any given serum. Further, he found that persons whose serum had, for example, a low opsonic content relative to one kind of germ, need not necessarily have a low content of opsonins which act upon some other kind of germ.

Again it was found that the serum from a person who had been suffering from some chronic infection was usually low in opsonic content as compared with the serum taken from a normal healthy individual; and likewise in acute cases of infection it was learned that the serum content of opsonins, relative to the specific bacterium causing this infection, did not remain from day to day within normal limits, but varied more or less. As the sera from many normal individuals were found to remain within definite boundaries, when examined at varying intervals, over long extent of time, this variation in the infected person's opsonic strength was considered significant.

Further, it was found by numerous estimations of the strength of opsonins in the sera of individuals suffering from the various infections that, as a rule, the patient getting worse or no better showed a lower strength than he did when getting better, or another would when he was recovering. Carrying out this idea further, Wright considered that one way to assist nature to resist infection was to bring about a higher strength in the opsonins of that patient's serum. It is upon this theory that vaccine therapy is based—i. e., a low opsonic content of a patient's serum is raised and maintained at a higher level. This aids in the phagocytic power of the patient's white blood-cells, as explained above, and therefore works toward the destruction of the invading germ. After long months of experiment Wright has devised:

1. A method of estimating the opsonic strength of a given serum relative to a given germ.
2. A method of raising that strength, if low, and maintaining it at a high point.

In order to have some standard for comparison the opsonic content of a patient's serum is always contrasted with that of a "normal" person's serum, and the result is called the "opsonic index."

and if the patient is, for example, a tuberculous one, we speak of the patient's tuberculo-opsonic index as being so and so. The normal index is always (arbitrarily) considered as 1. The patient's index may be 1 or above, or below 1.

In order to understand the method Wright devised for estimating the opsonic index we must consider the factors that enter into the actual mechanism of opsonification and phagocytosis in any given field of tissue. We have then—

(1) The opsonins in the patient's serum; (2) the white blood-cells, and (3) the invading germs, and then, for comparison, we must take a fourth factor—(4) the opsonins in a normal serum.

Opsonins so act upon the germs as to render them subject to phagocytosis. A serum strong in opsonins would cause more phagocytosis than one weak in opsonins. A definite amount of serum is, therefore, mixed with a definite amount of bacteria and to this mixture is added a definite amount of white cells. This mixture is all placed in a suitable receptacle and in an incubator for a certain length of time. During this incubation the opsonins have an opportunity of acting upon the bacteria, and then these satisfied bacteria are taken up by the leucocytes. To just what extent they are taken up depends the estimation of the phagocytic, and therefore the opsonic, power of the serum with which we are dealing. If we now take a drop of the incubated mixture and spreading it out on a slide, stain it with suitable stains, we can actually see and count the bacteria that have been ingested by the white blood-cells. If we count 50 or 100 cells, and the number of bacteria in each, we can estimate the average number in each cell. This is called the *bacterial average* of the patient's serum.

Now, if we go back and "run through" a similar experiment, using the same amount of the same leucocytes and the same amount of the same bacteria, with a similar amount of *normal* serum (obtained from the blood of a healthy individual) we can in like manner obtain a *bacterial average* of a normal serum under exactly the same conditions as we obtained the bacterial average of the patient's serum.

As has been explained above, we always consider the opsonic index of the normal as 1. Now to obtain the opsonic index of the patient we use a simple proportion. The normal bacterial average is to the patient's bacterial average as the normal opsonic index (1) is to the patient's opsonic index (or x).

The white blood-cells are obtained for such experiments from any healthy blood. The same cells are, of course, used in both mixtures. The bacteria are collected into a salt solution in suitable amounts. (The exact technique followed in the many different steps is quite accessible in the literature.)

Having a method then of estimating the strength of opsonins in a given serum we are to consider the two statements already made—that (1) it has been found that a patient not improving has usually a low index, and (2) if we raise that index, we can materially assist the patient in the struggle against the specific infection.

Wright has also, as said above, devised a method by which this

index can be raised and maintain important things happen when a (1) the number of white blood-cells as chemotaxis; (2) the opsonins increased in number. Just where poured out into the serum is not of endothelial cells lining the blood-vessels that they come from the fixed cells again believe that the opsonins cells themselves. However that is introduced, we find that for a time where are stimulated to secrete more increase in leucocytes and opsonic invading germ is overcome and some part of it is raised sufficient other hand, this does not take place therapeutic effort now is to increase opsonins by artificial means. Anticipating that although we can raise by other means, "this does not avail of an important discovery that if we find that are doing the mischief, and do more harm, and then inject into the bacterial suspension, the opsonic index be raised, and if proper inoculations at proper intervals, it is possible to maintain a high level.* This is the basis of the given to-day are suspensions in which that are causing the patient's infection and accurately measured as to the dose to treat a patient according to the results of make frequent examinations of the blood find that this index is low, we increase this index to the level of, say, 100. This is in contrast to the clinical estimations of the index are made at stated intervals and with dosage resulting in most clinical improvement.

This then is a mere outline of the method and vaccine therapy. There are, of course, technical, and practical factors to be considered in each step of the procedure before we reach the question of opsonins and their use.

Since the above technique, of the use of opsonins, has been brought out by Wright,

* Of how much real value it is artificially raised and what method (nucleic acid, horse serum, etc.) is a general tendency to-day toward attributing the effect to the white blood cell, and efforts are being energetically made to determine what conditions the greatest phagocytosis is

have been investigating the truth of his suggestions and claims. The great questions have been:

1. Of what importance are opsonins as a factor in immunity?
2. Can we truly estimate the exact content of a given serum in opsonins by this somewhat elaborate technique of Wright?
3. To what extent should we base our therapy upon the opsonic index, and to what extent upon the clinical findings?

The following will probably cover pretty accurately the present status of our knowledge in attempting to answer the above questions:

1. It is generally admitted that there are in the blood-serum chemico-physical bodies which have been appropriately called opsonins.
2. These opsonins have some specific action on certain bacteria as to render them more subject to phagocytosis.
3. "Normal" sera have pretty definite amounts of opsonic content, which do not vary to any great extent in health.
4. The opsonic content of a serum taken from an infected individual is quite apt to be found without the limits—*i. e.*, either above or below.
5. The value of a number of successive estimations of opsonic content is of distinct diagnostic value as to variety of bacterium causing the individual infection.
6. Administration of the so-called vaccines has a tendency to raise a low index if properly given as to time and interval.
7. Administration of vaccines at suitable intervals and with suitable dosage is very frequently followed by marked clinical improvement.
8. Just what part in the machinery of immunity opsonins play is not yet understood.
9. To exactly what extent we can rely upon the opsonic index (as estimated by our present technique) to be a *true* index of the opsonic factor in immunity we cannot yet say.
10. In spite of the wide-spread tendency to administer the vaccines according to clinical findings it is probably most accurate, in the majority of cases, to follow the index as a guide.

Vaccine therapy based upon opsonins applies, of course, to those bacterial diseases which are combated, mainly at least by phagocytosis. These include what is known as surgical infections and are represented, for example, by the streptococcus, staphylococcus, colon bacillus, gonococcus, tubercle bacillus. The blood has no bactericidal or antitoxic effect upon these organisms and it is *only* by phagocytosis, as far as we know, that these bacteria are resisted.

The best clinical results so far reported have been in chronic localized infections, such as lupus, tuberculosis of bones, joints, and urinary tract. In chronic staphylococcus infections of skin and subcutaneous tissues, as syphilis, boils, carbuncles and abscesses, quite marked improvement is often noted. In joints inflamed by the gonococcus and in chronic colon bacillus infections of bladder or kidney occasional cures are to be expected. Marked results are reported in individual cases of infections by streptococcus proteus, influenza bacillus, diplococcus intracellulans, etc.

PRESCR

A PRESCRIPTION (L. *præ*, for; pharmacist to furnish the patient of remedies made into the form prescriptions are, then, *simple* if and *compound* if containing more

The first element of correctness in so forming the prescription that the patient, understand it as the physician's interpretation by the pharmacist.

The names of drugs in prescriptions are in Latin, the advantages of this being that they are readable in any part of the country to the average patient, who frequently has notions of the efficacy of certain

English names are often applied. For example, "snake-root" is applied in different parts to plants *Cimicifuga racemosa*, *Arisæma*, *Eupatorium aromaticum*, &c.

The parts of the ordinary prescription are:

1. The name of the patient, as "Mrs. B—."
2. The symbol *Rj* representing "Recipe." This is known also as the *supercription*.
3. The names and quantities of the ingredients.
4. Directions to the pharmacist, whether to make the medicine, etc. Known also as the *subscription*.
5. Directions for the patient, written on the label. Known also as the *sigillum*.
6. The signature of the physician.

Example:

For Mrs. B——.¹

Rj * Olei morrhue,

Vini albi,

Glyceriti vitelli,

Fiat emulsio.²

Sig. Tablespoonful after meals.

* In ancient times it was customary to pray to Jupiter or some guardian deity. These prayers came to be expressed by the simple astronomical symbol \mathcal{R} . The upright stroke across the letter R headed the above heathen usage condensed in the present *Rj*.

Here the small numerals or exponents are ⁽¹⁾ the *superscription*; ⁽²⁾ the *inscription*; ⁽³⁾ the *subscription*; ⁽⁴⁾ the *signature*.

Formerly a typical prescription was said to consist of four divisions:

1. The *basis*, or principle active agent.
2. The *adjuvant*, or auxiliary, to aid the action of the basis;
3. The *corrective*, to correct or modify its action.
4. The *vehicle*, to give proper form or taste to the whole.

But it is not necessary that all prescriptions shall include the above four divisions.

Each ingredient should have a separate line

COMBINATION OF DRUGS

In writing a prescription we assume that it is intended, as should always be the case, to fulfil a single therapeutic purpose only, and we are to decide first, whether the medicine shall be administered in a solid or in a liquid form, and second, whether a single remedy or a combination of remedies shall be prescribed.

The tendency to-day, among many able therapeutists and clinicians, is to prescribe single drugs or simple combinations, while the prescriptions of former times containing a large number of ingredients, the so-called "shot-gun" prescriptions, are good examples of *polypharmacy*. There is, however, danger in going to the extreme of sacrificing therapeutic efficiency to simplicity of form and elegant pharmacy, and it must be confessed that such compounds as Warburg's tincture and the bolus prescribed by Dr. Graves in the treatment of dropical patients prove the efficacy of polypharmacy in many cases.

As a general rule, we prescribe only one drug to provoke emesis, and a combination of several if we wish a diuretic. A purgative is usually multiple, but if the selection be castor oil or croton oil, it will be single.

After we have selected the basis, or chief ingredient or ingredients, of our prescription, the next point to determine is whether we can add anything which will in any manner be of real assistance to that basis. This ingredient, or adjuvant—as it is called—has usually a physiological action similar to that produced by the basis, as in combining two cathartics or two diuretics to act upon different portions of the intestines or kidneys. Sometimes however an adjuvant may differ in its effects—as sulphuric acid serves as an adjuvant to quinine by favoring its absorption and thereby hastening and increasing its action, as mercury assists the action of squills upon the kidneys, or as iron is an adjuvant to a cardiac stimulant.

Having chosen the adjuvant, the next point to consider is whether the action of the drugs selected may not be rendered more kindly through the addition of some other substance as a *corrective*—that is to correct some disagreeable effect of the active agents. For example, extract of belladonna or hyoscyamus relieves the griping

occasioned by some of the more. Other well-known instances of the spirit of ammonia, which mitigates iodism, and hydrobromic acid, with quinine.

Great care and thought should be given to the vehicle, as an adjuvant, and corrective, but it should not receive equal attention. The vehicle is that which makes up the quantity to a definite form. It may be a substance with a pleasant taste. A prescription is often rendered more palatable by the addition of some substance which produces a pleasant taste. A mistaken idea that medicines, in general, are repulsive to the patient. The physician should take into the very agreeable taste of his patient, however, should not be a remedy, when, in the best judgment, it is well to study carefully the doses, so far as may be compatible with the palatability. It should be noted that pleasantness of taste is more readily obtained in fluids than in that of solids.

The favorite vehicles are: The cinnamon, peppermint, rose, clove, orange flowers and tolu; the ell. Some patients dislike sweet mixtures. Syrup, glycerin or pure water set. Although the physician's choice should be guided by the patient's experience.

Other things being equal, a liquid is preferable to a solid preparation; but for carrying about, pills, capsules, tablets are better. These should be given with water to aid disintegration, or to aid administration. Many substances administered in solid form are very irritating to the stomach; they should be disintegrated so that they are palatable. Tablets with strong irritating ingredients, such as potassium bromide, or ammonium chloride, should be given with water before administration.

The bitter taste of a remedy may be masked by the drug in capsules, or cachets, or coated pills; or, if a liquid, by adding aromatic or sweetened liquids.

Prof. H. C. Wood, M. D., has said: "The art of combining medicines is a science. We cannot do better than quote his words:—

"The art of combining medicines in practice certain principles should be followed. These are, to prescribe as few remedies as possible, to

powerful drug without a very distinct idea of what it is intended to do. Whenever it is desired to give a powerful remedy in increasing doses until its physiological effect is produced, it should always be given by itself. Thus, it may be necessary to give arsenic so as to impress the system, at the same time that iron is indicated, but the two remedies should be given separately, so that the dose of either can be increased or diminished independently of the other."

The principles of combination formulated below were long ago enunciated by Dr. Paris, but are to-day as imperative as ever. Medicines are combined:

"*First.* To augment, correct, or modify the action of a medicine. Thus, purgatives act much more kindly when a number of them are united together. The chief reason of this probably is that as different remedies affect different portions of the gut, the whole intestine is best reached by a union of the diverse substances. It may take an intense irritation of the mucous membrane to purge as actively as does a mild irritation of both the mucous membrane and the muscular coat.

"There are powerful medicines which act similarly upon some parts of the organism, but dissimilarly upon other parts. By combining such powerful remedies effects can be obtained at the points where the two lines of action cross each other, without influencing to a great extent other portions of the system. Thus, chloral produces sleep by its action upon the brain and also has a distinct influence upon the heart, but none upon the intestinal tract. Morphine acts upon the brain, and does not influence the heart, but has a powerful effect upon the intestinal tract. By combining chloral and morphine we get an overwhelming conjoined influence upon the brain in producing sleep, with the least possible disturbance of the heart and of the intestinal tract.

"*Second.* To obtain the joint action of two or more diverse remedies. Thus, in a cough-mixture, morphine may be included to quiet the cough, whilst ipecacuanha and squill (in accordance with the first principle) are added to affect the mucous membrane. The application of this principle requires caution or the practitioner will be led into that chief abomination—polypharmacy. It is worse than futile to attempt to prescribe for every symptom. It is the underlying cause of the disorder, or the under-stratum of bodily condition, which must be sought out and prescribed for simply.

"*Third.* To obtain a special combination which is really a new remedy, or which experience has shown acts almost as a new remedy. Thus, when to potassium iodide in solution corrosive sublimate is added a new chemical compound (potassio-mercuric iodide) is formed, which experience has shown to be of great value in syphilitic diseases. Griffith's antiseptic mixture (mixture fern comp.) is another instance of the use of chemical changes the protocarbonate of iron (ferrous carbonate being formed out of the sulphate of the metal and the potassium carbonate. In the famous Dover's powder no chemical change occurs, but the ordinary action

of opium upon the skin is so en-
bination may be looked upon as

"*Fourth.* To afford a suitable
make an emulsion, or confection
choice of excipients care should
free from medicinal properties,
with the medicinal agent and of
crumb often makes a good excip
it is chemically incompatible, or
contains.

"When writing a prescription
to use such excipients that the
attractive to the eye, but also i
may be. Whenever possible th
with bitter or disagreeable med
coated with silver-foil; tonic pi
shaking or rolling them in fer
Sugar-coated pills and 'compres
and insoluble that their use requir
flavoring oils should be freely u
conceal the disagreeable taste
remembered."¹

INCOMPATIBILITIES

When different substances, w
bined or associated and undergo
they are said to be incompatible,
two kinds: chemical and pharmac
in their physiological action are pr

The incompatibles and antag
are fully mentioned under the i
governing incompatibility, howev

Chemical incompatibility is of

The commonest forms of chem
the following conditions:

1. When a new and insoluble
mixture of solutions of soluble s
tions of lead acetate and zinc sul
ducing by chemical decomposition
sulphate of lead; which is precipi

2. By the addition of a stron
weak or volatile acids, such as c
resulting decomposition. Examp
salt of a weak acid radical, adde
acetic acid, causes decomposition
and the liberation of carbonic-acid

3. Salts of a feeble or volatil

¹ *Therapeutics*, 7th

addition of a strong alkali. Example (1) the evolution of ammonia when a strong alkali is added to ammonia alum, and when chloral hydrate is decomposed by alkalies, such as aromatic spirit of ammonia, lime solution, etc.

4. Alkaloids, or their salts, are thrown out of solution or precipitated from their solutions by the addition of alkalies or alkaline salts. Example (2) sulphate of strychnine in solution is precipitated as the insoluble bromide of strychnine by the addition of a larger proportion of potassium bromide. Quinine sulphate is precipitated as insoluble quinine acetate when mixed with a solution of potassium acetate.

5. Tannic and gallic acids and preparations containing them, as well as many other vegetable acids, produce discoloration or precipitation of iron and many of its compounds. Example (3), ink is the best illustration of this incompatibility. Writing fluids are usually combinations of tannic or gallic acid with some preparation of iron. Add the tincture of ferric chloride to tincture of cinchona, and notice the discoloration.

There are certain preparations of iron, like the compounds with ammonium or sodium citrate (see Tincture Ferric Citrate Chloride, N. F.), tasteless tincture of iron which produce little discoloration with vegetable astringents, and none at all with vegetable preparations containing no tannic or gallic acid.

Pharmaceutical incompatibility is the production of a sediment by change of solvent without chemical action. Examples, vegetable tinctures of resinous drugs with water, such as tincture of guaiac and water, copaiba and oils with aqueous preparations, spirit of camphor with water, spirit of nitrous ether with mucilage of acacia, etc. The separation or precipitation may frequently be prevented by the intervention of some viscid substance, such as syrup, glucose, glycerin, mucilage of acacia, etc.

The following is a reference-list of the common incompatibles of individual drugs:

SUBSTANCE	INCOMPATIBLE WITH
<i>Alumina</i>	Alcohol, acetates, borax, ferric chloride, lead salts.
<i>Ammonia</i> in general	Alkalies, metallic oxides, carbonates, and hydrogen salts.
<i>Acids</i>	
<i>Aceticum</i>	Ferric chloride, magnesium, lime water.
<i>Chloric</i>	Organic substances (as Ca , etc.).
<i>Sulphuric</i>	Iron compounds.
<i>Tannic</i>	{ Alkalies, acetates, sulphocarbonates, lime water, chloride water, albumen, gelatin, casein, salts of heavy metals, iron salts.
<i>Resinacæ</i>	
<i>Sodiumate</i>	{ Alcohol*, sulphur, tannin, sodium hyposulphite, arsenic acid, iodine, iodine (1), gas of meat.
<i>Chloral</i>	
<i>Hydrate</i>	{ Alkalies, carbonates*, ammonium and metallic oxides, potassium bromide, iodine.
<i>Iodine</i>	{ Ammonia*, alkalies*, carbonates, chloral, metallic salts, starch*.

SUBSTANCE.	INCOMPATIBLE WITH
<i>Lead</i> .	
Acetate	{ Acacia; acid hydrochloric, acid sulphuric and sulphates; alum [*] ; ammonium chloride; carbonates; lime water, iodine; potassium iodide, sulphides, tannin, zinc sulphate [*] .
<i>Mercury</i> .	
Bichloride	{ Potassium iodide [*] ; salts, carbonates; tannin; borax, alkaloids; lime water [*] .
Mild Chloride (Calomel)	{ Acids, acid salts, alkalies, carbonates; lime water [*] ; ammonium chloride; iodine, potassium iodide; ferric chloride, iodide, soap; sulphur.
<i>Potassium</i> :	
Chlorate	Acids, mineral; calomel; organic substances, sulphur
Iodide	{ Acids, acid salts; alkaloids, iron, lead and mercury salts; potassium chlorate, silver nitrate, chlorine water
Permanganate	{ Ammonia, salts, organic substances, alcohol, glycerin, ethereal oils.
<i>Sodium</i> .	
Bicarbonate	{ Acids, acid salts; alkaloids; bismuth subnitrate; calomel; metallic salts.
Bromide	Acids, mineral; chlorine water, mercury compounds.
<i>Silver</i>	
Nitrate	{ All organic substances (alcohol, glycerin, extracts, oils, starch, etc.), chlorides, bromides, iodides, alkalies; acids, hydrochloric and sulphuric.

Those marked with a * are sometimes directed to be compounded for the purpose of effecting some special change or producing new compounds.

Among the above, potassium permanganate forms an explosive mixture with glycerin; so does chromic acid. Chlorates of potassium, etc., explode when triturated with sulphur, tannic acid, or even particles of cork. The strong acids, nitric and sulphuric acids, and especially mixtures of these, react so strongly with volatile oils (hydrocarbons) as to cause explosion. Iodine affects these oils in the same way—fulminates.

It not infrequently happens that the physician intentionally writes a chemically incompatible prescription. "Black wash" (calomel and lime-water), and "yellow wash" (mercuric bichloride and lime-water) are examples. Other instances are such pharmacopœial preparations as liquor ammonii acetatis, mistura ferri composita, liquor magnesiæ citratis, and Blaud's pills.

ANTAGONISM.

Antagonists are drugs which are opposed to each other in their physiological effects.

Antagonism was formerly known as "therapeutic incompatibility," but, as this latter term has led to confusion, it is now thought best to limit the term "incompatibility" to chemical and physical changes, such as may occur in a prescription, and to give the term "antagonism" to physiological opposition.

No general rule can be laid down for the avoidance of antagonism. Some of our most valuable drugs contain active principles which are physiologically opposed to each other in their action;

instance: *jaborandi*, which contains two absolutely antagonistic alkaloids, pilocarpine and jaborine, the latter in small quantity, yet sufficient to control the action of the former.

Opium is a conspicuous example of a complex remedy, containing, besides gum, sugar, etc., eighteen different alkaloids, two neutral principles, and two peculiar acids, so that a prescriber of this drug, while he may, perhaps, flatter himself that he is conforming strictly to the present notions of pharmaceutical simplicity, is in effect a polypharmacist of most pronounced type. Moreover, not only are the constituents of opium very numerous, but, like others mentioned, the drug affords in its thebaine and morphine a further illustration of direct physiological antagonism.

Again, physiological antagonists are often given together, as atropine and morphine, or aconite and digitalis in certain cases of cardiac arrhythmia.

The author cannot too strongly recommend that physicians ignorant of the physiological action of drugs in large and small doses, if they prescribe at all, should avoid including many remedies in one prescription. But, given a competent and thorough knowledge of the action of drugs and the exact condition of the patient, the physician is justified in giving one or twenty drugs in the same prescription, since he is perfectly familiar with the several agents of relief, and can foretell with nicety the effect to be produced by their combination. In all cases a physician should be as certain of the action and strength of the preparations he administers as the surgeon of the aseptic condition of his hands and instruments.

ESTIMATION OF AMOUNTS.

Having decided upon the various ingredients which are to enter into the prescription, the next consideration is the desirable amount of each.

The bottles found in pharmacies have capacities of 1, 2, and 4 fluidrams, and 1, 2, 3, 4, 6, 8, 12, 16 and 32 fluidounces, or 4, 8, 12, 30, 60, 90, 120, 240, 500, and 1000 Cc., and it is wise to prescribe mixtures of these sizes, otherwise, the patient may fear some error from receiving a bottle only partly full, as when a 10-ounce mixture is placed in a 12-ounce bottle.

As a rule, it is better to prescribe small bottles rather than large. Always avoid ordering more of a medicine than the patient will probably need.

Having decided, then, how many doses to order, and the dose of each ingredient, it is a simple matter of multiplication to figure how much of each ingredient shall go in the prescription.

The following is a very simple rule for estimating amounts in Apothecaries' Measure.

In an *eight-ounce* mixture, the dose being a *drum*, take as many *drums* of the medicine as there are wanted *minims* or *grains* to the dose. It will be observed that in this case the basis is an *eight-*

ounce mixture, yet it typifies as understood, may easily be applied to a mixture, one-half or one-fourth as much is to be a dessertspoonful, or two take *one-half* as many drams to make for smaller mixtures in accordance with the tablespoonful, or four *drams*, one taken to an eight-ounce mixture, the dose. This rule, while not accurate for all practical purposes

Examples: We desire to give 10 grains for a dose, each dose to give bromide and 10 grains of chloral, and water. We have here, then, exact, therefore, we should have 10 or 12 drams and 48 grains; but, in a mixture 12 drams, since we desire we would require exactly 640 grains we use the round number, 10 drams in each case there is but the fraction

The prescription would consequently

R_x. Potassii bromidi
Chloralis,
Syrupi aurantii
Aquæ,

M. et. Sig.—Teaspoonful for

Or, if we wish the medicaments in the amounts and double the dose,

R_x. Potassii bromidi
Chloralis,
Syrupi aurantii
Aquæ,

M. et. ft. sol. Sig.—A dessert

The amount of each ingredient in a mixture, and *inversely* as the dose is greater the amount of the ingredient, and, the larger the dose the smaller the size of the mixture remaining

When writing a prescription for a mixture which are to enter into the composition, which is usually the vehicle, write the amount to be a four-ounce mixture, write "q. s. ad ℥iv." Then figure the amount by multiplying the amount of each ingredient and write it down. In other words, the amount given after the medicines have been

The next thing to be determined

medicine should be measured out to the patient for internal use. A graduated medicine-glass is always preferable to a domestic measure, and should be ordered in all cases. Teaspoons, as well as dessertspoons and tablespoons, vary considerably in size. A teaspoonful, considered to be equivalent to one fluidram, may contain from one-half to two fluidrams, a dessertspoonful, which should be equivalent to two fluidrams, and a tablespoonful, equal to one-half fluidounce, vary almost as much in capacity.

Ordinarily, it is unwise to prescribe medicines to be dropped out, since a drop varies greatly in dimension according to the viscosity and specific gravity of the fluid, the shape, size, and character of the neck and lip of the bottle, the degree of fullness of the bottle, and the steadiness of the hand in dropping.

Drops, therefore, are not accurate measures. Sometimes, however, it is desirable to order medicines in drops, and then it is well to remember that aqueous liquids and fixed oils drop about one drop to the minim, and volatile oils and alcoholic liquids such as tinctures or fluidextracts, drop about two drops to the minim.

There are exactly 60 minims of any fluid in 1 fluidram, while 60 drops may be greater or less than 1 fluidram, as the following list shows:

	Drops = 60 (Gr. M.)	Weights of Gr. Gr.	Gr.
Aether carboaleum	111	50	3.52
Aether sulphureum aromaticum	140	55	3.41
Aether tartari	170	50	2.52
Chloroformum purissimum	250	80	1.56
Cereus fati	122	50½	1.50
Fluidextractum hamamelidis	150	57	1.50
Fluidextractum rosarum virginianarum	160	55	1.50
Fluidextractum digitalis	134	62	4.11
Liquor calomelans	61	59	1.52
Liquor potassii arsenicatus	57	53	3.65
Oilum caryophylli	130	57	1.50
Oilum tigli	114	50	3.24
Spiritus aromaticus camphoratus	142	48	3.11
Syrupus ferri iodidi	64	77	4.25
Syrupus ictericus-compositus	102	71	4.11
Tinctura camphorata	140	46	2.25
Tinctura belladonnæ	137	53	1.41
Tinctura castoreæ	131	51	1.35
Tinctura ferri chloridi	152	43	1.41
Tinctura nucis vomicæ	161	44	2.53
Tinctura opii	130	53	5.61
Tinctura veratri	145	47	2.52
Vinum cretæ-compositum	111	54	3.47

LANGUAGE AND GRAMMATICAL CONSTRUCTION OF PRESCRIPTIONS.

A prescription is written partly in Latin, partly in English. The name of the patient and the date should be in English; the superscription in Latin abbreviation; the ingredients in Latin; the directions to the pharmacist in Latin or Latin abbreviations; and the directions to the patient in English or Latin.

A prescription properly and unmistakably written is a cardinal requisite to the successful administration of medicine, no less than to its correct preparation by the druggist. The reasons for the employment of Latin in prescriptions have already been given, and it is well for every practitioner and pharmacist to possess some knowledge of Latin grammar. Still, by the observance of a few simple rules, one wholly ignorant of the language may acquire a proper use of the forms generally adopted; and a little study, aided by constant practice, will soon fix in the memory the peculiarities of gender, case, and number, and the agreement of adjectives, to be met with in all prescriptions.

VIRIS

The imperative singular is employed in the superscription *R—* *i. e., recipe*, "take (thou)," and in certain directions to the pharmacist, as *miscet*, "mix"; *divide*, "divide"; *fac*, "make"; *solve*, "dissolve"; etc.

The subjunctive mood, having the force of the imperative, is also used, as *quantum sufficiat*, "as much as may suffice"; *fiat, fiant*, "let be made" (as *fiat mistura*, "let a mixture be made," or *fiant in pilulas*, "let the ingredients be put into pills"); *bulliat*, "let it boil"; *ne repetatur*, "do not let it be repeated," "do not repeat"; *dividendur*, "let them be divided," etc.

A future passive participle is also frequently used: *dividendus*, like an adjective agreeing with the noun in gender, case, and number, and signifying "to be divided (into)," as in the order *in trochiscos dividenda* (massa), "to be divided into troches."

NOUNS.

Latin nouns are declined according to five different plans, and these are known as the five declensions. Four cases are used in prescription-writing: nominative, genitive, accusative, and ablative.

Most nouns ending in *a* are of the *first* declension, are feminine, and are declined as follows:

Singular.

Nominative	—	Oliva	—	Olive (subject).
Genitive	—	Olivæ	—	of Olive.
Accusative	—	Olivam	—	Olive (object).
Ablative	—	Olivâ	—	with Olive.

Plural.

Nom.	—	Olivæ	—	Olives (subject).
Gen.	—	Olivarum	—	of Olives.
Acc.	—	Olivas	—	Olives (object).
Abl.	—	Olivis	—	with Olives.

An exception is Aloe.

Nom. — Aloe.
Gen. — Aloes.
Acc. — Aloen.
Abl. — Aloe.

[The Latin dative and vocative cases are never used.]

Medical nouns of the *second* declension end in *us, os* (masculine, except *juniperus, prunus, sambucus, and ulmus*, which are feminine), or *um, on* (neuter), as.

<i>Singular.</i>	<i>Plural.</i>
Nom. — Oleum — Oil (subject).	Olea — Oils (subject).
Gen. — Olei — of Oil.	Oleodrum, Oleum — of Oils.
Acc. — Oleum — Oil (object).	Olea — Oils (object).
Abl. — Oleo — with Oil.	Oleis — with Oils.

[The genders of nouns are given as a guide to the agreement of adjectives.]

Or

Nom. — Juniperus.
Gen. — Juniperi.
Acc. — Juniperum.
Abl. — Junipero, etc.

Indeed, all prescription nouns ending in *us* are of the second declension, save seven—*rhus, rhos* (3d fem.) and the six names of the fourth declension (see p. 641).

The *third* declension does not follow such strict rules as do the others, and its endings are variously modified in their attachments to the root. These modifications are not indicated in the nominative, but are expressed in the genitive, so the nominative and genitive should always be learned together. It should be observed that, no matter what the connecting-links between the roots and the endings may be, the latter are always the same, viz. in the singular, gen. *is*, acc. *em*, abl. *e* or *i*; in the plural, nom. *es* or *a*, gen. *um*, acc. *es* or *a*, abl. *ibus*. The nouns of the third declension may be grouped as follows.

GROUP I.—Thirty-three nouns ending in *us* make the genitive in *is*. All are masculine, save *Asclepias* (Gen. *Asclepiadis*), which is feminine, and all are names of salts. Example.

Singular

Nom. — Nitrax.
Gen. — Nitratis.
Acc. — Nitratem.
Abl. — Nitrato, etc.

GROUP III.—

Nouns ending in *o*, all feminine except *Cārbo*, *Pēp Sāpo*, which are masculine:

(a) Genitive ending in *ōnis*.

Ex. Nom. *Lōtio*; Gen. *Lotiōnis*.

(b) Genitive ending in *inis*.

Ex. Nom. *Mucilāgo*; Gen. *Mucilāginis*.

GROUP IV.—

Nouns ending in *x*, masculine or feminine:

(a) Genitive ending in *ctis*.

Ex. Nom. *Bōrax*; Gen. *Bōracis*.

(b) Genitive ending in *ctis*, and the last vowel of the nominative (*e*) changed to *i*.

Ex. Nom. *Rūmex*; Gen. *Rūmícis*.

GROUP V.—

Nouns ending in *r*, masculine or neuter:

Genitive simply adds *is*.

Ex. Nom. *Liquor*; Gen. *Liquōris*.

GROUP VI.—

Nouns ending in *a*, all neuter:

Genitive ends in *atīs*.

Ex. Nom. *Enēma*; Gen. *Enēmatis*.

GROUP VII.—

Nouns ending in *s*, masculine or feminine:

- (a) Genitive simply adds *is*.
Ex. Nom. Chloral, Gen. Chloralis.
(b) Genitive doubles *l* and adds *is*.
Ex. Nom. Mel; Gen. Mellis.

GROUP IX.—

Nouns ending in *n*, all neuter:

- (a) Genitive ending in *onis* (nominative in *on*).
Ex. Nom. Limon; Gen. Limonis.
(b) Genitive ending in *inis* (nominative in *en*).
Ex. Nom. Semen, Gen. Seminis.
[Erigeron has the genitive *Erigerontis*.]

GROUP X.—

One noun ending in *e*, neuter:

Genitive simply adds *is*.
Ex. Nom. Lac; Gen. Lactis.

GROUP XI.

One noun ending in *us*, feminine: nom. *rhus*; gen. *rhoas*.

There are only six medical nouns of the fourth declension, *cornus* and *quercus* (feminine), and *fructus*, *haustus*, *potus* and *spiritus* (masculine). They are declined as follows:

<i>Singular.</i>	<i>Plural</i>
Nom. — Spiritus.	Spiritus.
Gen. — Spiritus.	Spiritum.
Acc. — Spiritum.	Spiritus.
Abl. — Spiritu.	Spiritibus.

Of the fifth declension we use the ablative *die* of the noun *die*, a day, as in the expression *ter in die* "three times a day."

The following nouns are usually considered indeclinable: *Azedarach*, *buchu*, *catechu*, *condurango*, *curare*, *cusso*, *dactylon*, *crocodetyon*, *jaborandi*, *kino*, *matico*, *quebracho*, *sago*, and *sassafras*.

ADJECTIVES.

These are many and must agree in gender, number and case with the nouns which they qualify. They are declined like nouns of different declensions, having the same cases and numbers, and may be divided into two classes.

CLASS I includes all but fourteen of the adjectives used in prescriptions. The nominative has three distinct endings: *us* masculine, declined like the second declension of nouns; *a* feminine, declined like the first declension; and *um*, neuter, declined like the second declension. Example:

Singular.

	<i>Masc.</i>	<i>Fem.</i>	<i>Neut.</i>
(1) Nom.	Ūnus,	Ūna,	Ūnum.
Gen.	Unius,	Unius,	Unius.
Acc.	Ūnum,	Ūnam,	Ūnum.
Abl.	Ūno,	Ūna,	Ūno.

Plural.

(2) Nom.	Dūo,	Dūæ,	Dūo.
Gen.	Duōrum,	Duarum,	Duōrum.
Acc.	Dūos,	Dūas,	Dūo.
Abl.	Duōbus,	Duabus,	Duōbus.

Plural.

	<i>Masc.</i>	<i>Fem.</i>	<i>Neut.</i>
(3) Nom.	Trēs,	Trēs,	Tria.
Gen.	Trium,	Trium,	Trium.
Acc.	Trēs,	Trēs,	Tria.
Abl.	Tribus,	Tribus,	Tribus.

[The *ordinal* numbers, *primus*, *secundus*, *tertius*, etc., are not used in prescription-writing.]

CONJUNCTIONS—ADVERBS.

Conjunctions are rare, except *et*, and. Adverbs are very seldom employed, except *bene*, well.

PREPOSITIONS.

Three prepositions govern the *accusative* case: *ad*, to, up to; *in*, into; and *supra*, upon. Others are rarely used.

Two prepositions, oftenest used, govern the *ablative* case: *cum*, with, and *pro*, for.

MUCH-USED WORDS AND PHRASES AND THEIR COMMON ABBREVIATIONS.

Ad libitum (*ad lib.*), at pleasure.

Ad saturandum (*ad sat.*), to saturation.

Ana (*ad*), of each.

Bene, well.

Bis, twice.
Bis in die (*b. i. d.*), twice a day.
Cibus, food.
Cochleare medium (*cochl. med.*), a dessertspoon(ful).
Cochleare magnum (*cochl. mag.*), a tablespoon(ful).
Cochleare parvum (*cochl. parv.*), a teaspoon(ful).
Collutorium (*collut.*), a mouth-wash.
Dein, afterward.
Dimittus, half.
Dosis (*dos.*), a dose.
Et, and.
Extende supra, spread upon.
Gradatim, gradually.
Gutta (*gut.*), a drop.
Guttatim, drop by drop.
Hora, an hour.
In die, daily.
Lagena, a bottle.
Libra, a pound.
Linteum, lint.
Mane, in the morning.
Mane primo, early in the morning.
Mena panis, a breadcrumb.
Non, not.
Nocte, at night.
Numerus, a number.
Numero (*No.*), in number.
Octarius (*o.*), a pint.
Omne die (*o. d.*), every day.
Omne mane (*o. m.*), every morning.
Omne nocte (*o. n.*), every night.
Partes æquales (*part. æq.*), in equal parts.
Pro et quatenus (*p. e. q.*), as required.
Quantum sufficit (*q. s.*), as much as is necessary.
Quaque hora (*q. h.*), every hour.
Quaque quatuor hora (*q. q. h.*), every four hours.
Saturatus, saturated.
Scatula (*scat.*), a box.
Semel, once.
Semis (*ss.*), a half.
Semisdragma, (*ss.*), half a dram.
Simul, together.
Sine, without.
Si opus sit (*s. o. s.*), if necessary.
Statim (*stat.*), immediately.
Tales (*tal.*), such.
Tales doses (*tal. dos.*), such doses.
Tere simul, rub together.
Ter in die (*t. i. d.*), three times a day.

much, conjugations,
 matter is likely to be

- (1) Nom. *Ūn*
 Gen. *Ūni*
 Acc. *Ūn*
 Abl. *Ūn*

- (2) Nom. *Ūn*
 Gen. *Ūni*
 Acc. *Ūn*
 Abl. *Ūn*

- (3) Nom. *Ūn*
 Gen. *Ūni*
 Acc. *Ūn*
 Abl. *Ūn*

Sugar, lbs. 10—

[The *ordin.*
 used in prescrip-
 tions to that of the above prescrip-
 tions taken as a type for all, subject to
 the nature of the drug and the treatment may

Conjunction-
 employed, ex-

Three pre-
 tions, into; and
 Two pre-
 with, and p-

MUCH-

difficulties in writing prescriptions correctly are
 caused by the almost exclusive use of the *genitive*. Yet
 it is clear that the use of the *accusative* in all
 medicine is made into objects, as powders, cap-
 sules, etc. names of such are the immediate *object* of the
 verb, and cannot be placed in the *genitive*.

Example:

R. *Pilulas* (not *Pilularum*) *Fern Iodici* (No. xii)

Where the mass is mentioned or implied in the prescription the general rule of the *genitive* is followed, as: R. *Unguenti Belladonnae* (a portion); and where the terms *fiat*, *fiant* are expressed, the *nominative* is naturally used, as, for example,

R. *Masse hydrargyri*, gr. xxx;
Fiant pilulae No. x
 Sig. Take one at bedtime

Here *pilulae* is the subject of the Latin irregular verb signifying "to be made," no case save the *nominative* being admissible. We may, however, write "*fiat* (or *fiant*) *pilulas* No. x," the subject of the verb being the word for ingredient or ingredients (understood).

It has been presumed in the foregoing pages that all prescriptions are to be written in full—a practice which, could it meet with universal acceptance, would not infrequently be of vital importance alike to patient and practitioner. Custom, however,—and in certain cases advantageously—has authorized the extensive use of *abbreviations*, although the dangers of carelessness or ignorance in their employment will be apparent if we consider that, for example, *Ammon.* may mean either *Ammonia* or *Ammoniacum*, *Chlor.*, *Chlorum*, *Chloral*, *Chloroformum*, *Chloras*, or *Chloridum*; *Hydr.* (*chlor.*), *Hydrate of Chloral* or *Hydrargyri Chloridum Corrosivum* or *Mite*; *Sulph.*, *Sulphur*, *Sulphas*, *Sulphidum*, or *Sulphur*, *Zinc.*, *Phos.*, *Zinci Phosphas* or *Zinci Phosphidum*.

These are but few of the many instances of ambiguity occasioned by inadvertence or want of familiarity with the full Latin form, or at least its recognized and unmistakable abbreviation.

In conclusion, let the writer of prescriptions be warned against too great haste and a cursive which none but its author can decipher—a deficiency for which he alone is responsible though the onus may fall upon the luckless druggist or his bewildered clerk.

With regard to form, it has been our object to show that there is really little difficulty in writing good prescription Latin, and where the slightest chance of error exists the amule expression, as we have strongly urged, should be used. A clear, business-like method, deliberately chosen and consistently pursued, will render this important item of the physician's labor simple, agreeable, and efficient.

It is wisest not only that the directions to the patients should be written in perfectly legible English and in full, but that they should contain the exact dose, time for, and method of taking, and, in short, every detail which may be advisable for the patient and nurse to know, clearly and intelligibly expressed. A physician is

seldom justified in writing merely "As directed," the full directions being the only clue to the safety of the medicine. Moreover, verbal instructions to the patient or attendant may be partially or even wholly forgotten, or confounded with directions relating to other matters connected with the case, and thus the welfare of the patient be endangered.

The terms "For external use" or "Shake before using" will be applied by the pharmacist as indicated by the character and use of the prescription, and need not be specified by the physician; but the pharmacist never applies a "Poison" label to a prescription unless specifically directed to do so.

Should it be necessary to prescribe an extraordinary dose of some powerful drug, the name of the remedy should be underscored or attention called to it by a \times , referring to the bottom of the prescription, where should be written: "Large dose intended," or "Dose of above correct," or something to indicate to the pharmacist that the writer is fully aware of the unusual amount, and thus save delay in consulting with the physician—which a careful and competent druggist would otherwise do. Should it, in the opinion of the physician, be undesirable to repeat the prescription, he should write at the bottom, "Do not repeat," or the customary Latin, "*Ne repetatur.*"

In the case of a poor patient the letters *P. P.* after the name will insure the lowest price from the druggist.

Every prescriber should be supplied with suitable prescription-blanks arranged in the form of pads conveniently carried in the pocket, a suitable size being four by five inches. The paper should be of linen, of good quality; otherwise it is liable to become detached from the druggist's files and lost. A convenient form of pad is composed of prescription blanks with interleaves and copying paper, so that the physician may always retain an exact record of the remedies ordered for his patient.

It is certainly advisable for the physician to write his prescriptions invariably in ink, since pencil is easily erased, and a prescription thus perishable would be of little use in medicolegal emergencies. Besides, an unscrupulous druggist who had been careless in compounding the remedy might easily change the pencil instructions to conform to his mistake. Finally, the pencil-writing is always liable to be erased or partially obliterated when carried for some time or subjected to frequent handling.

The prescription-blank should have printed neatly upon one margin or the back the physician's residence and office, together with hours for consultation, and telephone number if he has one. This advertises the physician to some extent in a legitimate way, besides enabling the patient or druggist to communicate with him readily if necessary.

The prescription should always be signed by the writer in full, that professional responsibility and identity may be assured, the academic "*M. D.*" being preferable as a title to "*Dr.*," which is

applicable to various professions—often of questionable repute and authenticity.

In concluding these practical hints, the author cannot too strongly impress upon the student the importance of always writing as clear, legible, complete, and classical a prescription as possible. In a new community the reputation of the recent graduate is often dependent upon the character of the prescription he writes. The druggist invariably scans his instructions from the new doctor critically, and the lady and the profession will soon learn the young aspirant's proficiency or ignorance by his public committal in a prescription. No matter how able a diagnostician, pathologist, or bacteriologist he may be, if his first effort in *prescription-writing* be illegible, in poor Latin, or for a hopelessly incompatible mixture, the druggist will label, classify, and measure him with the keenness of professional insight; the judgment will go forth quietly; and years of successful practice may not serve to eradicate that first unfavorable impression.

It would be well to remember the following simple rules of good usage in prescription-writing.

- 1 Solids are weighed, liquids measured.
- 2 Very potent substances are placed first.
- 3 Solids are written first in a liquid preparation, and liquids first in a solid preparation.
- 4 Never employ "ditto" marks.
- 5 Abbreviation is good usage: (1) in the name of the kind of preparation, as *elix* for *elixir*, *linct* for *linctura*; (2) in the directions to the pharmacist; (3) in certain well-recognized expressions in the directions to the patient (for example, *t i d* for three times a day), but abbreviation is never allowable when there is possibility of ambiguity.

If in doubt as to what is correct, write in plain English.



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